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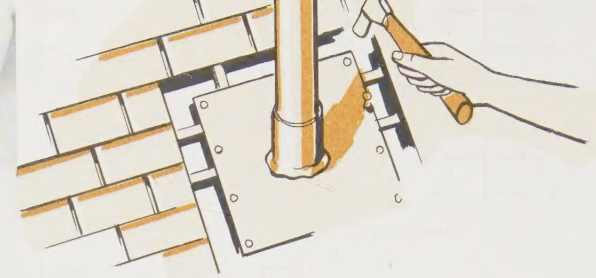
11

LATHE
MODEL CAR LAYOUT

DO-IT-YOURSELF

Complete Handyman do-it-yourself Encyclopedia



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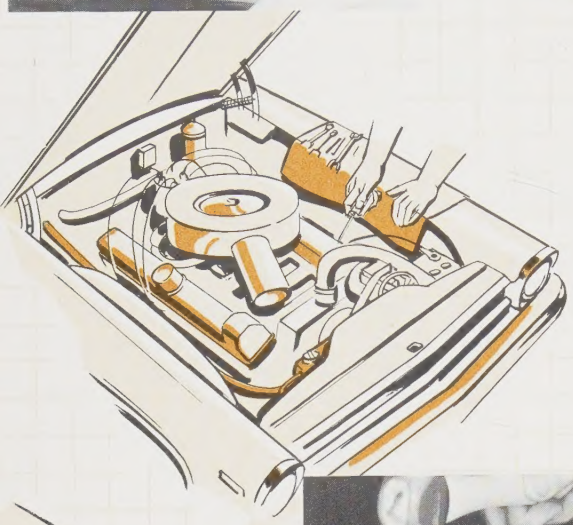

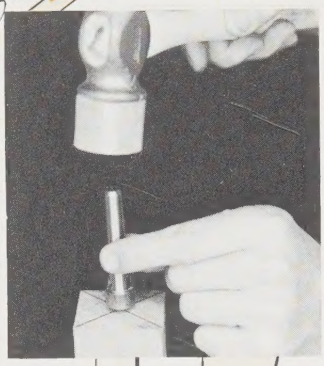

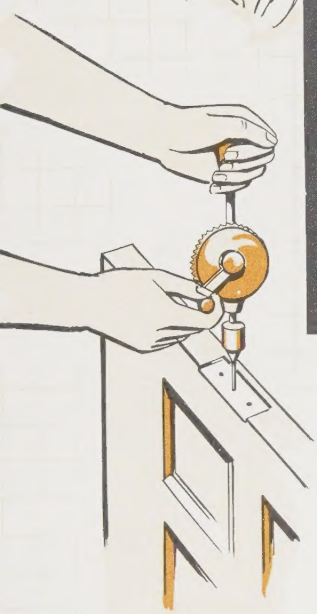

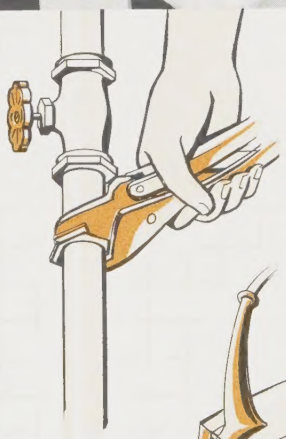

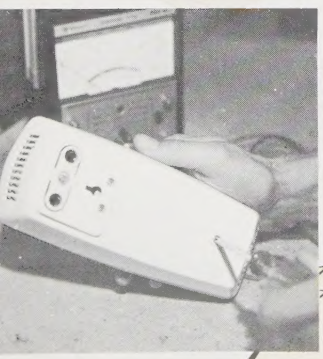

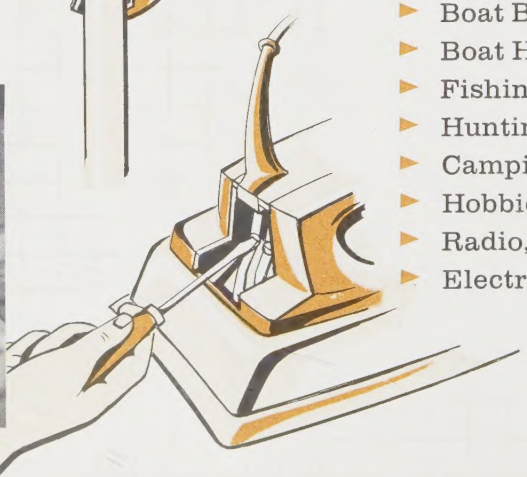

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Complete Handyman yourself Encyclopedia

A COMPILATION OF SPECIAL INTEREST PROJECTS AND MANUALS FOR THE REPAIR AND CARE OF HOMES, AUTOS, APPLIANCES, HOBBY EQUIPMENT.

by the editors of

Science & Mechanics

11

LATHE

MODEL CAR LAYOUT

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VOLUME 11

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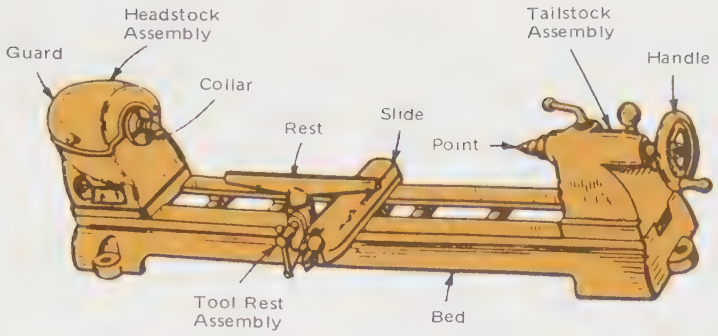


The Wood-turning Lathe

This is one of the most versatile tools for the home craftsman, but in order to use it effectively you must be aware of how it works, the tools you need, and most important, what you can make on it

A WOOD-TURNING lathe is an indispensable tool in the home workshop. It is used for making turnings, shaping cylindrical parts of wood-working projects, drilling holes, and for other applications where it is required that the workpiece be rotated about its axis.

The "swing" or size of a lathe is the maximum diameter of material that can be turned on it. To determine the swing of a lathe, measure the height of the centers over the lathe bed and multiply this distance by two. If the height of the centers is five inches, for example, then the swing of the lathe will be ten inches. For general wood-working purposes secure a lathe that is at least 36 inches long between centers, with a swing of 9 inches to 10 inches.

The lathe bed should be constructed of heavy steel. Those constructed of either rods or sections of pipe are subject to vibrations which make them unsuitable for wood-turning projects that require highly accurate work.

The headstock is one of the most important parts of the lathe, since the power for turning the work is applied at this point. A typical well-designed four-speed lathe headstock has the necessary strength at the points supporting the spindle. It is solidly cast to eliminate any danger of its working loose. The choice of speeds on this type of lathe makes it an ideal tool for all general wood-turning. Slow speeds are for turning work of large diameter or for roughing-out. The high speeds are used for finishing, sanding, polishing, drilling, routing, or grinding.

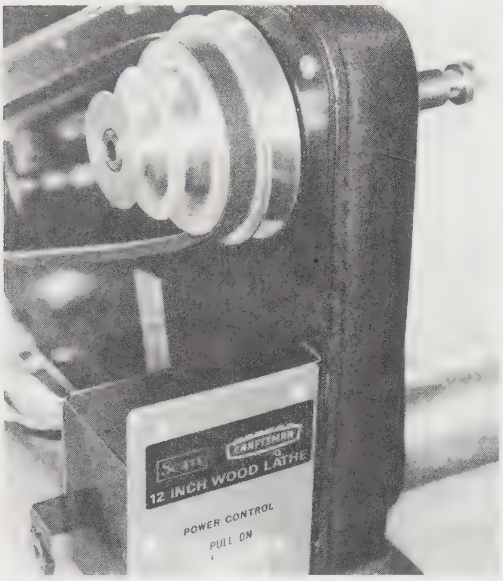
The headstock spindle should be made from a solid bar of hard steel, accurately ground and polished, so that it will have a perfect surface for the precision ball bearings on which it spins. It should be large enough to withstand strains placed upon it in turning large pieces of work.

Another important point to consider in the choice of a lathe is the quality of the headstock bearings and the provision for their lubrication.

The tailstock is used to support the other end of the work that is being turned between the centers. The tailstock, like the headstock, must be of sturdy construction

launching: see safety, boat
launching from trailer: see boating

to prevent vibration. It must be accurately machined and fit properly between the rails of the lathe bed, so that, no matter in what position the tailstock is secured, perfect alignment between the lathe centers is kept. One movement of the lock lever should release the tailstock for repositioning or tightening onto the bed. This eliminates the use of wrenches.

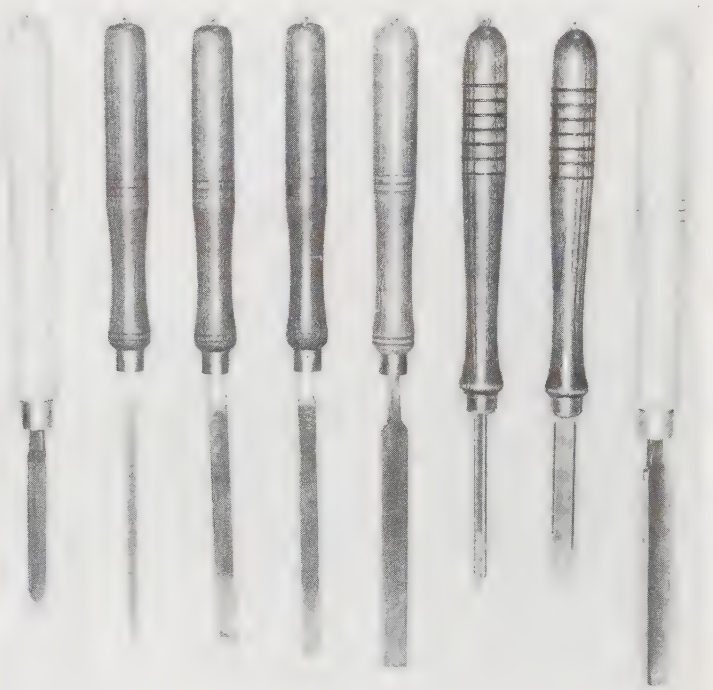


▲ *Solidly cast headstock with belt guard raised shows spindle bearing assembly and pulley.*

The dead center which fits on the end of the tailstock spindle should be either cone- or cup-shaped with a replaceable pin at its center. The cup-shaped type is preferable for centering the work and keeping it true.

The tool rest must be designed and constructed so that the hand guiding the tool used for turning can be moved easily along the side of the tool rest in a parallel line with the work being turned. The base that supports the tool rest must be rigid, and long enough to give proper clearance for the tool rest when turning work of large diameter. To clamp it tightly to the lathe bed the tool rest should have a strong clamping device.

The following lathe tools and accessories are necessary for wood-turning: ½- and



➤ *A typical collection of wood-turning chisels includes (left to right) parting chisel, round-nose chisel, two skews, flat-nose chisel, and three gouges.*

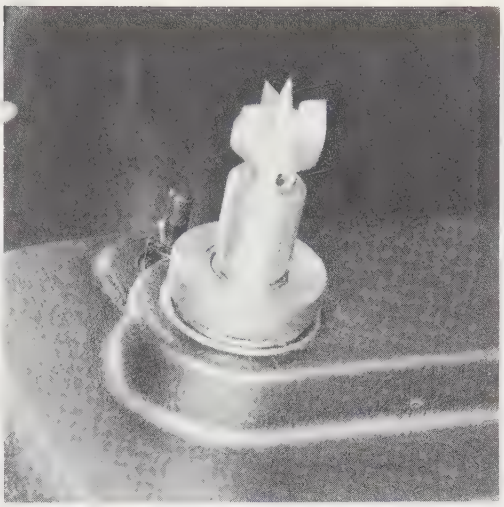
¾-inch gouges, ½- and 1-inch skews, ⅛-inch parting tool, ½-inch spear-point tool, and ½-inch round-nose chisel.

In addition to the above, the following measuring tools should be secured: an ordinary 12-inch rule, 6-inch inside caliper, 6-inch outside caliper, and a pair of 8-inch dividers.

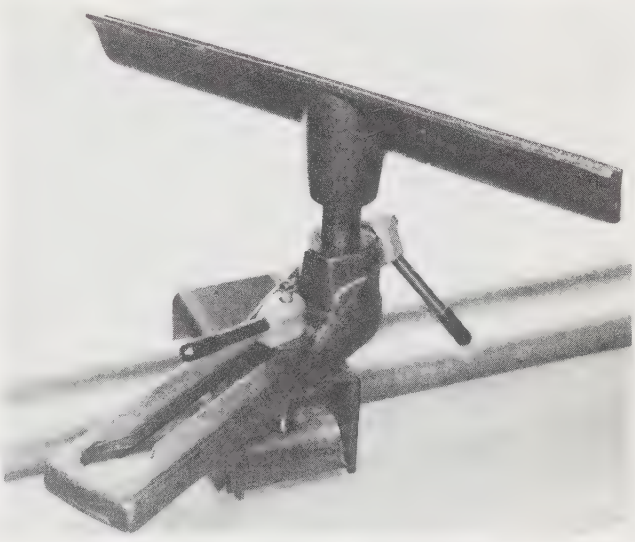
All wood-turning tools are divided into three groups: roughing-off tools, smoothing and cleaning-up tools, and scraping tools. All of the cutting tools listed above fall into one or more of these three groups.

Whenever possible, the lathe should be mounted on the left-hand side of the workbench. It should be placed so that the headstock end extends slightly beyond the end of the bench. The motor should be mounted below the lathe. A convenient height to set up the lathe (for a person of average height) is with the center of the headstock about 42 inches to 45 inches from the floor.

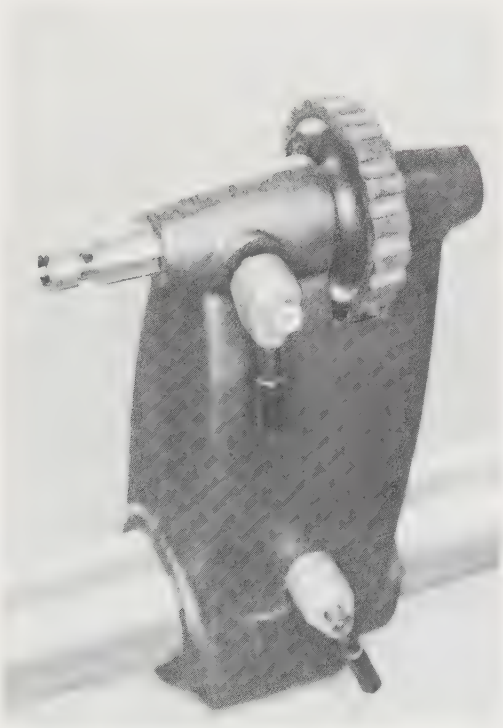
The ideal wood-turning lathe has four



Spur center with point is one of several different kinds of centers used on the headstock. Chuck can be mounted onto threaded portion of spindle when spur center is removed.



Lathe tool rest assembly is seen above the lathe bed. Bed should be made of heavy steel.



Lathe tailstock showing lever-controlled bed-lock built into some of the newer lathes.

TURNING SPEEDS

Size Stock	Roughing Off	General Cutting	Finishing
3″ dia.	500-1,200	1,200-1,800	2,000-3,000 r.p.m.
4″ dia.	600-1,000	1,000-1,500	1,800-2,400 r.p.m.
5″ dia.	600- 800	800-1,000	1,000-1,800 r.p.m.
Over 5″	200- 500	200- 500	400- 500 r.p.m.

speeds: 700, 1350, 2200, and 4000 rpm. As far as speeds are concerned, considerable latitude is permitted in wood-turning. In other words, where a speed of 1350 is specified, any speed ranging from 1100 to 1600 can be used with safety.

The turning speed of the lathe is largely governed by the size of the stock being turned. When turning small diameter stock, use a faster speed than when turning larger diameters.

Unless the center points on the ends of the stock to be turned are not properly located, a considerable amount of vibration will result, and it will be impossible to make an accurate turning. To locate the exact center point on the end of square stock, draw diagonal lines across the end. On round material determine the center point quickly by the use of a pair of dividers or calipers. Then make two diagonal saw cuts across the end that is to be at the headstock of the lathe. With a soft-faced mallet drive the spur of the headstock faceplate into the saw-cut at the center point. Never under any circumstances drive the piece of wood against the headstock of a lathe by hammering on the far end. This will ruin the bearings on the lathe, and in time will knock the headstock out of correct alignment. To keep the lathe in good working condition never do any hammering on the lathe itself.

Two methods are used in wood-turning —the scraping method and the cutting method. The scraping method is slower, but is far simpler to master without an instructor, and has the added advantage of being more accurate than the cutting method. Where speed of operation is not important the scraping method of wood-turning is recommended, especially for the beginner. If you have become skillful in this phase of craftsmanship and desire to speed up the work, then by all means attempt the cutting method. In the basic operations that are described here, the scraping method will be discussed first.

Replace the spur center on the headstock and tighten the setscrews. Press the work to be turned against the spurs, so that they center the groove in the end of the material.

Move the tailstock of the lathe so that the point of the dead center of the tailstock is approximately ½-inch from the end of the material. Tighten and secure the tailstock firmly to the lathe bed. Proceed by turning the handwheel of the tailstock so that when the head center enters the material it will be set in so firmly that the work cannot be turned by hand. Turn the handwheel in the opposite direction to loosen it just enough so that the work can now be turned by hand. Tighten the dead-center clamp at the top of the tailstock to hold the spindle firmly in position.

The proper adjustment of the tool rest is the last preliminary operation before starting the actual turning. The tool rest must always be adjusted so that its top is from ⅛- to ¼-inch above the centers. The top of the tool rest must never be set below the centers or below the center of the piece that is being turned. The top edge of the tool rest must always be parallel to the stock, and about ⅛-inch away from the

farthest projecting edge of the stock. Revolve the stock by hand to ascertain that it has the proper amount of clearance. Be sure that all clamps are tight and all necessary adjustments made before turning on the power. Take a position in front of the lathe with the left side turned a little nearer to the lathe than the right. When working on a lathe avoid wearing loose apparel that may be caught by the moving parts of the lathe.

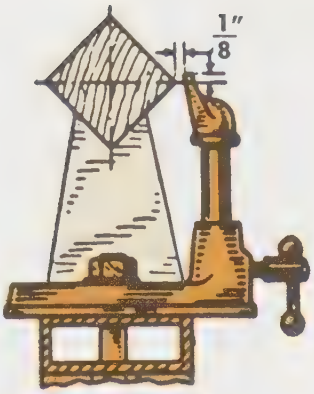
The first step in the process of shaping a rectangular piece of material to cylindrical form on a lathe is called roughing. This process consists of cutting off the square corners of the material until the piece is approximately cylindrical.

Use a large gouge for making the roughing cuts. The stock must be properly centered and mounted, and the tool rest adjusted. Assuming that the stock is not over three inches square, the lathe should be run at a comparatively slow speed and the V-belt should be placed on the second largest pulley.

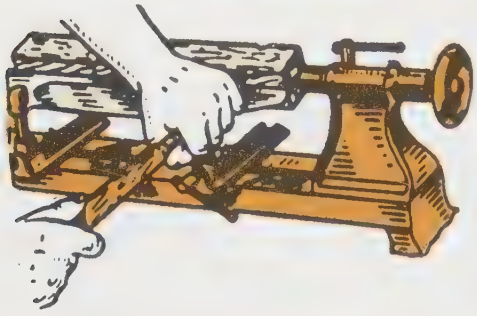
Hold the gouge in the left hand with the hand against the tool rest and the fingers around the tool. Hold the extreme end of the handle with the right hand and drop the wrist slightly, to permit the side of the left hand to act as a sliding guide along the tool rest. The cutting end of the gouge must be held above the material with the handle held lower. To make the necessary shirring cut, roll the gouge just a trifle toward the right; lift the handle slowly as the work revolves and force the cutting edge of the tool into the wood. For proper disposal of the flying chips, hold the tool at an angle to the axis of the work. Make the first cut several inches from the dead center. Never start a cut at the end of the stock; the cutting tool is apt to catch and be forcibly

▲ *Drive spur into center of stock so that prongs mark the wood, then deepen the cuts by making 1/16-inch deep saw cuts. If the stock is perfectly square, make saw cuts first along center-finding diagonals since they will match the spur prongs. Note plastic hammer.*

◀ *Cup center with point is removed from tailstock and tapped into other end of work. Predrill shallow hole when working with hardwood. Lubricate point of contact with drop of oil. Use plastic hammer to drive in cup center.*



The proper positioning of the tool rest preparatory to roughing the stock is a must.



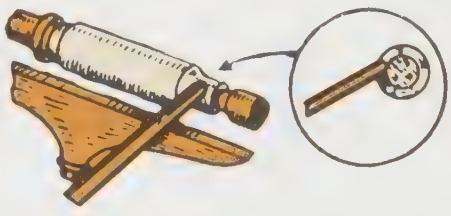
Using a large gouge, make roughing cut on the stock at relatively slow lathe speed.

thrown from your hand. When rounding off the material do not take long cuts; large chips or slivers of wood are apt to fly off, causing injury to you and to the material. Start the second cut several inches to the left of the first and continue in the direction of the first cut until both meet. When combined, these cuts are called the primary roughing cut. When making this primary roughing cut do not attempt to shape the material to a perfect cylindrical form of the required dimensions. During roughing, check dimensions of the cylinder with the calipers. Continue to move the gouge back and forth from right to left on the tool rest until the entire piece of stock is cylindrical in form and approximately ⅛-inch larger than the largest diameter of the turning. The cylinder is now ready for shaping or sanding.

The parting tool is used to make the next series of cuts, called sizing cuts. Move the belt to the next smaller pulley to obtain a faster speed.

Readjust the position of the tool rest to ⅛-inch from the cylinder, and tighten in place. For purposes of elementary instruction, assume that the material is to be turned to a perfect cylinder. Set the calipers to a diameter 1/16-inch greater than that required for the finished work. This allowance has to be made for the finishing cuts and final sanding.

Hold the calipers in the left hand and the parting tool in the right. Start the lathe running. Using the parting tool, cut a narrow groove in the work several inches from dead center. Take light, thin shavings and do not exert too much pressure on the tool. As the work proceeds, check with the cal-



The gouge held so the cutting edge is above center axis of the stock, the handle below.

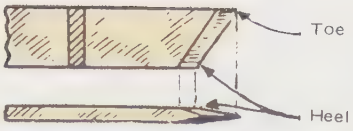
A parting chisel and calipers are used in sizing the stock. The calipers should be set 1/16-inch larger than the desired diameter of the stock to allow for finish cuts and sanding.

ipers the depth of cuts made. Stop cutting when the leg of the calipers passes over the cut without any pressure. Repeat the operation at intervals of about one inch for the entire length of the work. These grooves are called parting or sizing cuts.

Cutting and smoothing the cylinder to the required dimension is the next and final step. This is called the finishing cut. When making this cut on the lathe by the scraping method, use a square-nose turning chisel or an ordinary woodworking firmer chisel with a long blade. A short-bladed chisel cannot be held properly on the tool rest. Hold the chisel with the beveled side of the blade down and flat against the top of the tool rest. Use a scraping action and run the tool along the entire length of the material until the cylinder has been smoothed down to the required dimension. Test for squareness with a straightedge laid lengthwise against the work. If it is not perfectly straight, give the work another light scraping with the same tool.

A large skew chisel is the tool used for smoothing cylinders by the more difficult but faster cutting or paring method. It must be laid on the tool rest with its cutting edge above the work and at an angle of approximately 60° to the surface of the work. Draw the chisel back slowly toward you, and raise it until it begins to cut at a point approximately ¼-inch above its heel. Hold it in proper position. Start the cut several inches from the right end of the work and work toward the right by sliding the left hand and the tool along the tool rest. Turn the chisel in the opposite direction and cut the remaining portion to the left end of the work. The use of the skew chisel in cutting cylinders smooth is more difficult than the scraping method. A close study of the illustrations and directions plus continued practice on scrap material are necessary before using the cutting or paring method.

When the material has been turned to a perfect cylindrical form of the required dimension, it is ready for turning or forming to any desired shape or combination of shapes that constitute a finished turning.

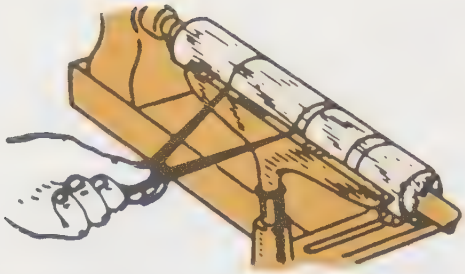


Skew chisel is used for finishing a cylinder by tricky, but efficient, paring method.

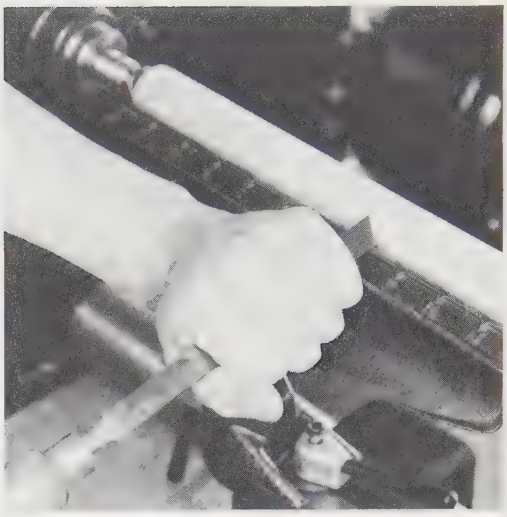
A finishing cut with a long bladed chisel brings the stock to a true cylinder. Check cylinder for squareness with a straightedge.

Make a full-size dimensioned drawing of the projected turning. Then indicate the points where the sizing cuts are to be made and mark them on the drawing. With a pair of dividers transfer these points from the drawing and mark them on the cylinder. Mount the cylinder in the lathe between the two centers. Place the point of a pencil on each of the marks made by the dividers and revolve the cylinder by hand to mark the entire circumference. Set a pair of outside calipers for a diameter 1/16-inch larger than required, as shown in the full-size drawing or pattern, at the point where the first sizing cut is to be made.

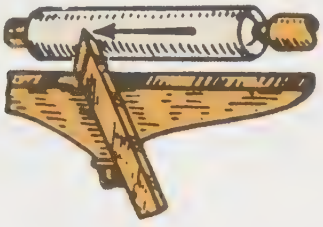
The parting tool is used to make the sizing cuts. Place its narrow edge on the tool



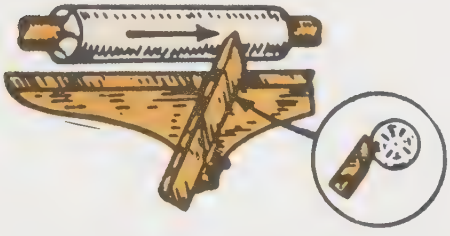
Transfer the location of the sizing cuts from the full-scale drawing with dividers.



This is the proper hold and positioning of skew chisel when turning a cylinder.



Position of the skew chisel when cutting left; contact work 1/4-inch above heel.



This sketch shows the correct position of the skew chisel in cutting toward the right.

Location of sizing cuts along the axis of the work. The number of cuts you must make in given length increases when rate of change of curvature increases. Line shows final shape.

rest with the point above the line of the centers. Set the point on one of the pencil marks on the turning, start the lathe, raise the handle of the parting tool, and push the point into the material. Check the accuracy of the sizing cut by holding the previous set outside calipers in the groove that has been cut. Continue cutting until the calipers slip easily over the work. Set the calipers for each of the subsequent sizing cuts and proceed in the same manner. Wood turnings usually consist of several types of cuts, called taper, concave, convex, and bead cuts.

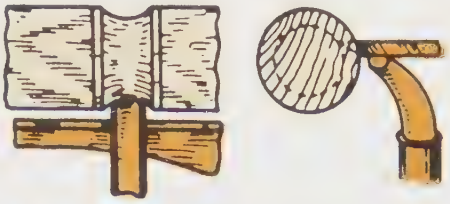
The round-nose chisel or the gouge is used to make taper cuts by the scraping method. Always cut from the larger to the smaller end of the taper. With the chisel, cut down to within about 1/8-inch of the entire depths of the sizing cuts previously made with the sizing or parting tool, using the same procedure as outlined for forming the stock to cylindrical form. Finish with the square-nose chisel. As cutting proceeds, check the work with the calipers.

The skew chisel is used to make taper cuts by the more difficult cutting method. Place the chisel on the tool rest at an angle of about 60° to the surface of the material and slightly above it. After starting the

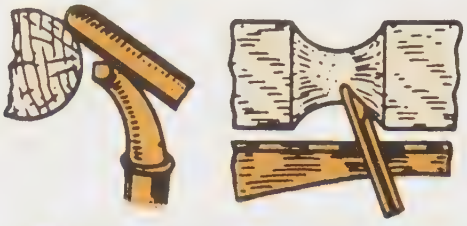
lathe, draw the chisel back just a trifle, until the heel starts the cut, then draw it a little farther down and back to the original position. Repeat these movements until the actual cutting is being done by the heel of the tool. The entire taper cut can be made with the heel. Avoid the danger of making deeper cuts than required and eventually ruining the turning. The rule of starting the cut from the larger and proceeding to the smaller end of the taper applies also to the cutting method. You should not attempt the cutting method until you have acquired considerable skill in the use of the lathe and lathe cutting tools.

The round-nose chisel is used to make concave cuts by the scraping method. After making the parting or sizing cuts and checking dimensions with the calipers, place the round-nose chisel flat on the tool rest with the bevel side down. Hold the tool slightly above the center of the work at right angles to its axis. Start the lathe and begin the cutting at the top. Complete the concave cut by light cuts with the chisel, working down on each side of the cut previously made by the parting chisel, to within $\frac{1}{16}$-inch of the required depth. The remaining material can be removed by light smoothing cuts.

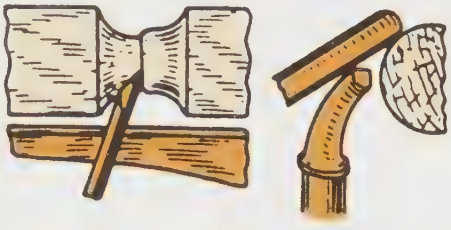
This is the position of the gouge at the start of a "rolling" cut when making concave cuts by the cutting or paring method.



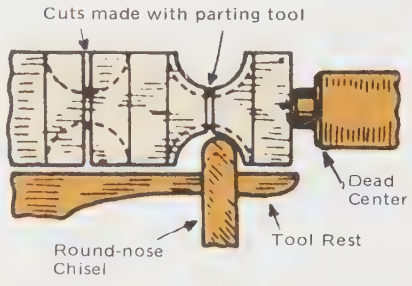
Method for making concave cuts.



Cutting position of tool on rest.



Right-hand concave cutting direction.



Scraping method for concave cuts.

A gouge is used for making concave cuts by the more difficult cutting method. Hold the tool in a horizontal position with the hollow part up. Start the cut at the top.

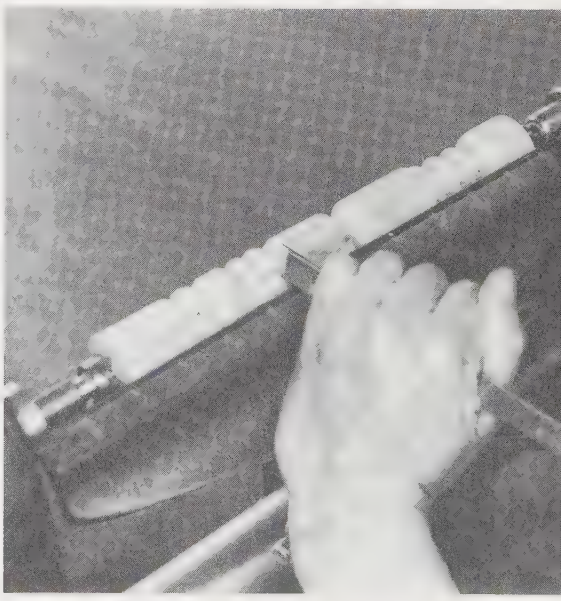
Roll and push the tool forward simultaneously to the right and down toward the bottom of the cut. Note the exact position of the gouge, its necessary rolling motion and the angle of the tool to the work. Always start the cut from the high point in the design and work to the lowest point. Then reverse the position of the tool and start the cut at the top of the other left side. The bottom of each side must then be cut alternately, and the cutting tool repeatedly shifted from right to left until the required shape of the concave cut has been produced.

The diamond-point or the parting chisel is used for bead or convex cutting by the scraper method. Mark the cylinder for the beads as for the other cuts previously described. With either tool make the cut to the desired depth. Hold the diamond-point chisel at a slight angle to the work to round out the corners of the bead. The parting tool can be used instead of the diamond-point chisel when the beads on the turning are not close together. Round out the right-hand corner of each bead first, then reverse the tool to round out the left corner. Repeat the operation for each bead.

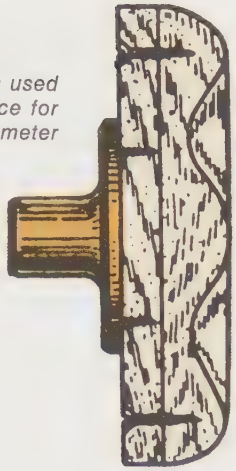
The skew chisel is used for making beads or convex curves by the cutting or paring method. Mark the cylinder where the cuts are to be made. Make the cuts to the required depth with the toe of the skew chisel. Then place the skew chisel flat on the tool rest and at right angles to the axis of the turning. Start cutting at the top of the cylinder, with the heel of the chisel. Turn the tool gradually and draw it toward

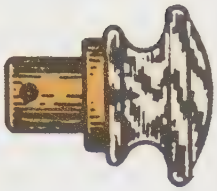
Proper position of gouge at end of a rolling concave cut by cutting or paring method.

The technique of turning a bead with a skew chisel is an art.



This faceplate is used with a backing piece for handling larger diameter wood stock.

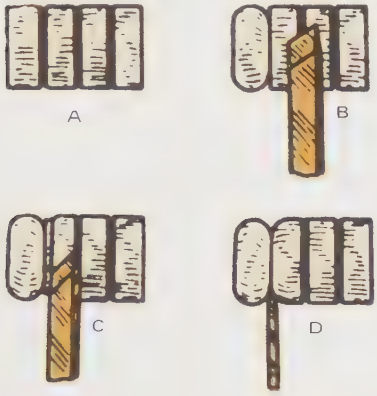




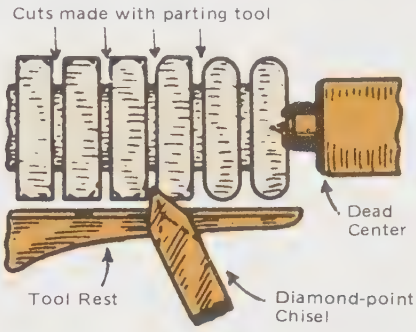
Shown is faceplate with center-screw.

With the backing piece, screws can be inserted at the best place to secure the work.

Cutting joined beads with the skew.



Separate beads can be cut on the stock using a parting tool and diamond-point chisel.



you simultaneously as the bottom of the curve is reached. Then reverse the chisel to cut the other side of the bead.

When the work to be turned cannot be held between the live and the dead center on the lathe, a faceplate is used. There are several methods of fastening the work onto the faceplate. The choice of the one to be used is largely dependent upon the shape and size of the turning. "Center screw work" is used for forms that do not require any deep cutting in the center, such as knobs or rosettes, and for other small ornamental turnings. For center screw work a hole is usually provided in the center of the faceplate through which a screw is inserted.

Where work of a larger nature is to be done, or where the turning is to be deep, such as a salad bowl, platter, or other large and ornamental piece, a large faceplate is used. This has several holes through which screws are inserted, from the back, into the material that is to be turned.

Before attaching it onto either type of faceplate remove all surplus wood from the material by drawing a circle on it a trifle larger in diameter than desired for the finished work. Cut this circle out with a scroll or band saw. Center the work accurately when screwing it to the faceplate. If the material being used is hardwood, drill small holes in it to start the screws. Use short, heavy flat-headed screws that will enter the work not more than ⅜-inch

to ½-inch. Make certain that the work is securely fastened to the faceplate and that the ends of the screws will not come in contact with the cutting tool when the work is being turned.

When the shape of the finished work is such that contact with the screws cannot be avoided, the work must be backed up with a disk of the same size. Bore and countersink the holes for the screws at points where they will not come in contact with the tool. Screw this extra disk on the work and attach the faceplate to this extra disk, or backing piece as it is called.

Place the faceplate on the end of the lathe spindle and tighten the setscrews.

Next place the tool rest so that its top edge is about ⅛-inch above the center of the revolving turning. Use a large chisel to turn the outside of the work roughly to within ⅛-inch of the required diameter.

The various speeds used for faceplate work are dependent on the diameter of the stock, and are essentially the same as for cylindrical turnings. Consult the accompanying table of speeds. When the material has been turned to approximately the finished diameter, readjust the tool rest to a position where its T-section is across the face of the turning and at right angles to the center of the lathe bed.

Use the large gouge first in spacing off the turning, if the material is not smooth. Then true up the surface with the flat-nose chisel. If the work is of large diameter, use the straight edge of the chisel; on smaller diameters, the side of the chisel can be used.

When making concave cuts, use either the large or the small gouge, or the ¼-inch or ½-inch round-nose flat chisel. Hold it perfectly flat on the tool post and use a scraping cut. For making rounded-off or beaded members use either the skew-point, the diamond-point, or the flat-nose chisel and employ the same type of cuts.

To sandpaper turnings in the lathe, Numbers 0, 000, 0000, and 00000 are usually used. Cut strips of sandpaper about one inch wide. These must be held in both hands with the right hand above, and the left below the turning. To avoid cutting grooves, keep the sandpaper in motion while the work is turning in the lathe. Fold the sandpaper and use the edge of the fold to get into the bottom of a V-shaped cut.

After sanding the turning smooth, finish and polish it in the lathe. Dilute commercial shellac with an equal quantity of wood alcohol. Make a pad of cheesecloth about two inches square. Dip this into the diluted shellac and then put several drops of a good grade of machine oil on the pad. Hold the pad lightly on the revolving turning, keeping it in contact with all parts of the work and in motion all of the time. The heat generated by friction will harden and glaze the shellac so that it becomes necessary from time to time to redip the pad. Each time the pad is dipped into the shellac additional oil must also be dropped on the pad.

Another method of finishing turnings is with beeswax, carnauba, or ordinary paraffin wax. Hold the wax in lump form against the turning as it revolves. The heat generated by friction will melt a portion of the wax and deposit a coating on the turning. After the entire turning has been coated, hold a wad made of soft tissue paper against the turning to give it a good polish. If a higher polish is desired, repeat the entire operation.

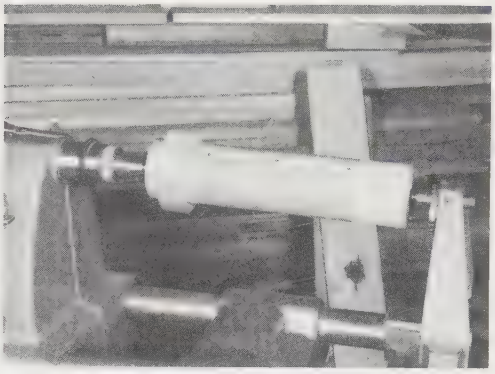
All manufacturers of lathes issue specific lubrication directions. To keep the lathe in good working condition these directions must be followed.

Keep the cutting edges of all lathe tools sharp and free from nicks. The procedure for sharpening the chisels and gouges used for wood-turning are the same as those for grinding and whetting wood chisels.

See also: CHISELS; INLAY WOODWORKING; SHARPENING; WOODWORKING.

Duplicating Odd Shapes with a Lathe Jig

This jig is designed for the lathe and can be used to make any shape for which you prepare a template



The sanding drum is shown ready for use; note the three screws in the hardwood strip.

Before sanding the stock, remove excess wood with a chisel.

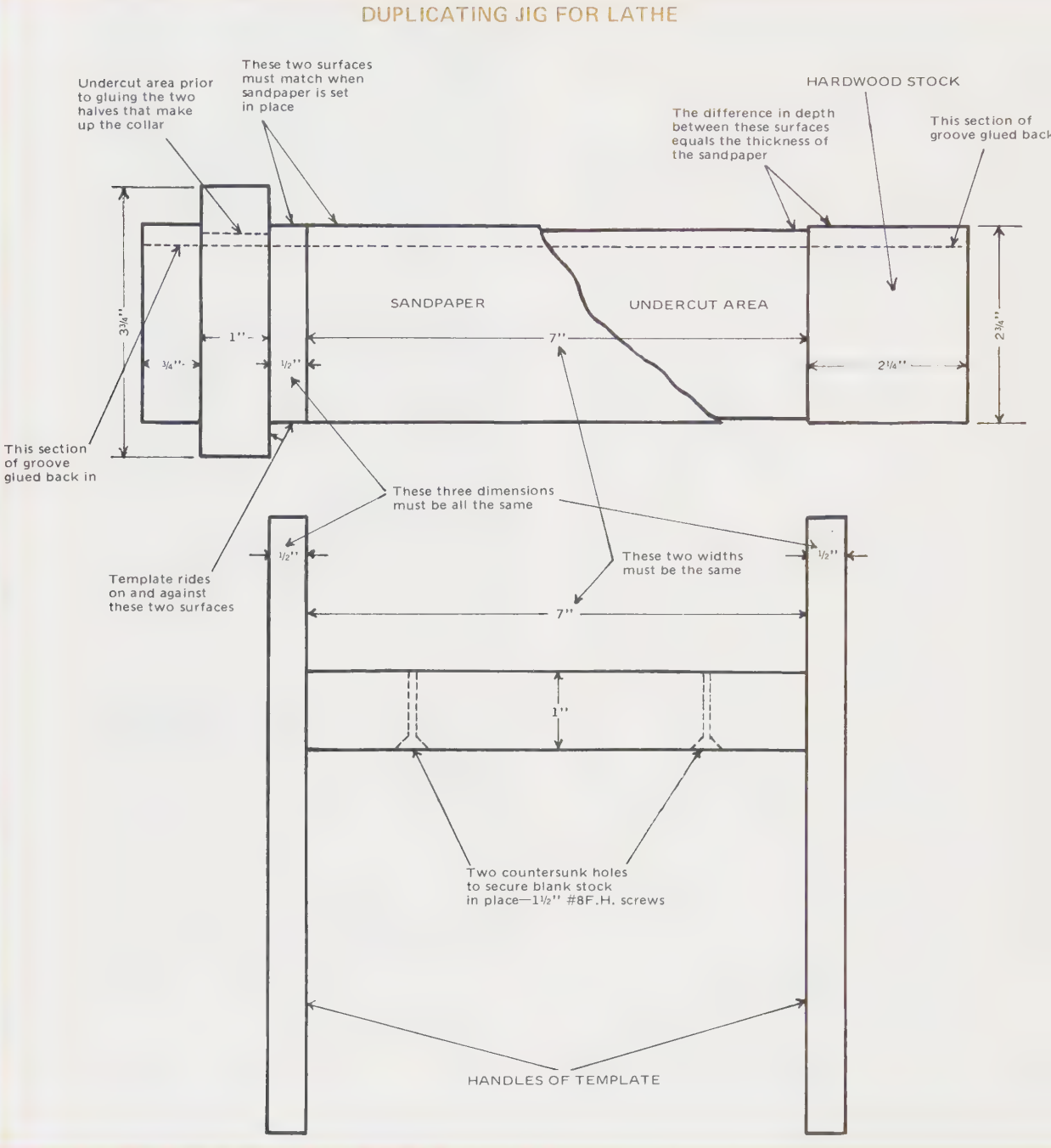
MANY TIMES THE HOME CRAFTSMAN must duplicate odd and difficult shapes. Making them by hand means a tedious expenditure of both time and effort. This handy little jig, designed for the lathe, can be used to make any shape for which you prepare a template.

The jig consists of two parts. The first is a lathe-mounted sanding drum and the second is the template, or templates, which you cut to any shape you desire to duplicate.

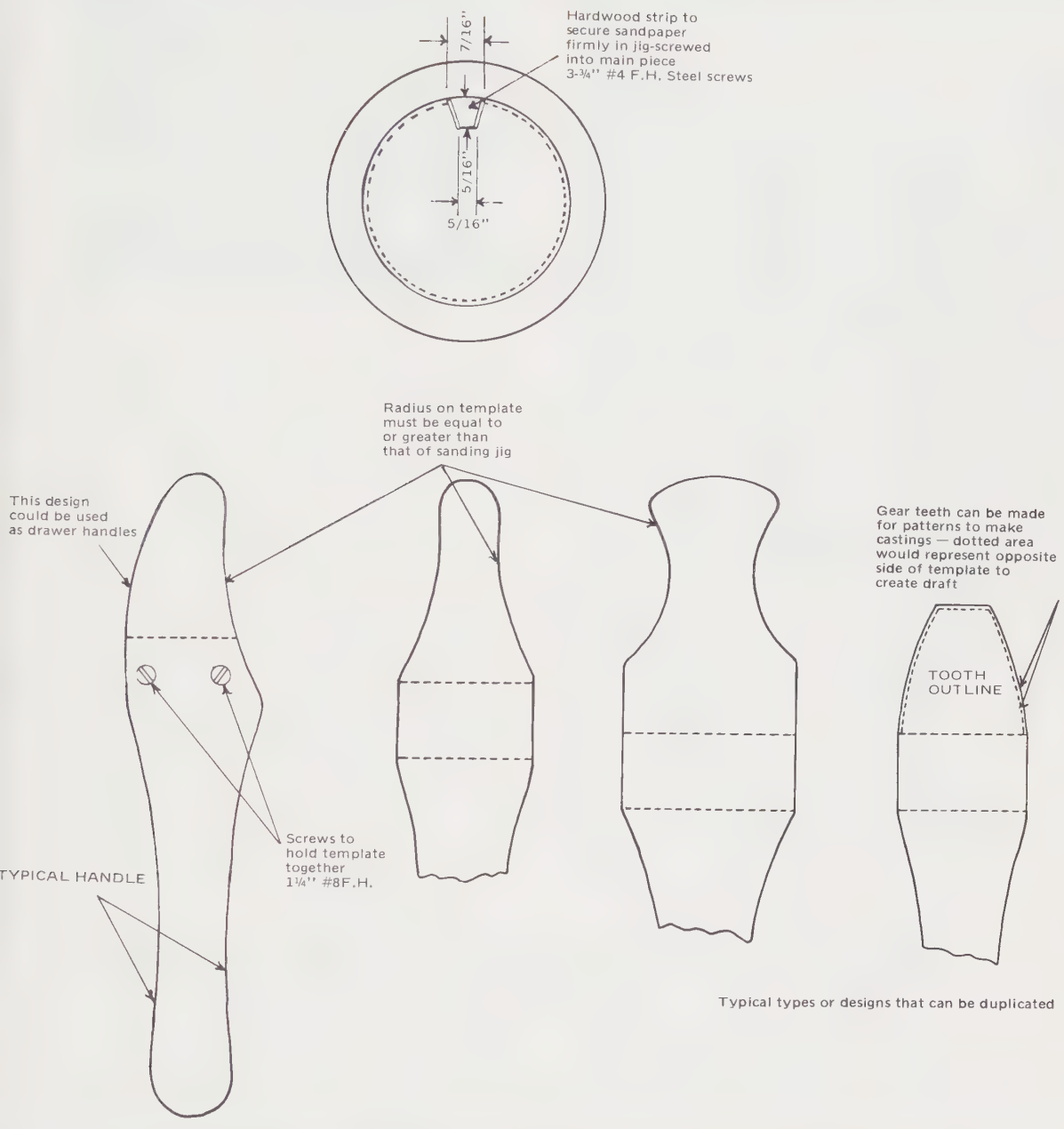
The sanding drum. The drum is turned from hardwood stock 2¾ inches square and 11½ inches long. On one end of the square stock, lay out the drum diameter and groove for a strip of hardwood to hold the sandpaper tightly in place. Refer to the photograph and the drawing for dimensions. Use your table saw to cut out the groove. You can make the hardwood strip to fit the groove at this time and screw it in place for the rest of the turning operation. Chuck the block in the lathe and turn it to the 2¾-inch diameter.

It should be mentioned that the 2¾-inch diameter for the sanding drum was arrived at by some experimenting. This diameter allows the sanding of small radii without sacrificing sanding area per revolution. But if you desire to sand smaller radii, you can reduce this dimension accordingly.

Now undercut the area of the drum that


DUPLICATING JIG FOR LATHE
Undercut area prior to gluing the two halves that make up the collar
These two surfaces must match when sandpaper is set in place
HARDWOOD STOCK
The difference in depth between these surfaces equals the thickness of the sandpaper
This section of groove glued back
SANDPAPER
UNDERCUT AREA
3¾"
1"
¾"
½"
7"
2¼"
2¾"
This section of groove glued back in
These three dimensions must be all the same
Template rides on and against these two surfaces
These two widths must be the same
½"
½"
7"
1"
Two countersunk holes to secure blank stock in place—1½" #8F.H. screws
HANDLES OF TEMPLATE

holds the sandpaper. It should be cut to a depth of the heavy grade sandpaper you will generally use for bringing the work to shape. Finer sandpaper for finishing can be backed up to bring it to the 2¾-inch diameter. After this area is turned, remove

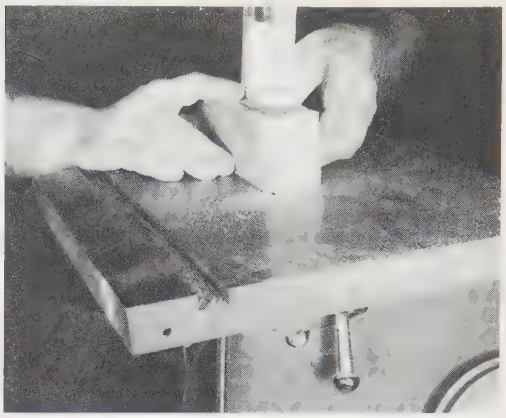

7/16"
Hardwood strip to secure sandpaper firmly in jig-screwed into main piece 3-¾" #4 F.H. Steel screws
5/16"
5/16"
Radius on template must be equal to or greater than that of sanding jig
This design could be used as drawer handles
Gear teeth can be made for patterns to make castings — dotted area would represent opposite side of template to create draft
TOOTH OUTLINE
Screws to hold template together 1¼" #8F.H.
TYPICAL HANDLE

Typical types or designs that can be duplicated

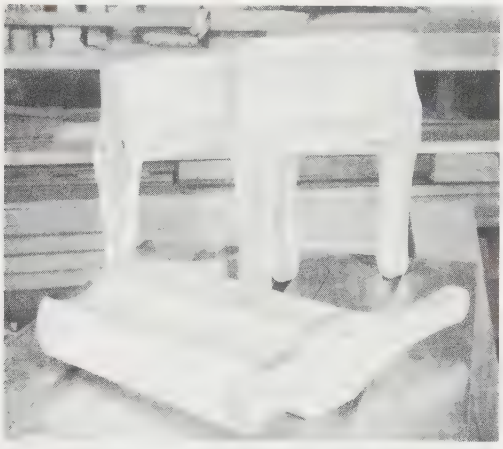
the hardwood strip and cut it into three pieces—one that screws into the drum to lock the sandpaper in place, and the other two pieces to glue back into the ends of the drum.

Next undercut a one-inch wide area on

The desired shape to be duplicated is drawn on the end of hardwood stock. Stock is trimmed on band saw before it is clamped in jig to be chiseled and sanded.



The finished shapes are still in the templates.



Finished shapes are already cut, chiseled and sanded, ready for use.

the headstock end of the drum for mounting the collar stop. Bandsaw two half segments for the collar and glue them in place on the drum. After the glue is dry, you can turn the collar down to perfect round. Just clamp in a sheet of sandpaper and the drum is ready for use.

Templates. The templates illustrated are representative of the many shapes, such as drawer pulls, duplicated with the jig. It is up to the home craftsman to lay out the template face that he desires to duplicate. The handles, too, may vary their shape according to the template shape being used. For the template face, remember that any inside radius on the jig template cannot be smaller than the radius of the sanding drum.

E.P.K., SR.

See also: ABRASIVES; INLAY WOODWORKING; JIGS; POWER TOOLS; WOODWORKING.

MATERIALS LIST

Quantity	Size and Description	Purpose
1	$2\frac{3}{4}$″ $2\frac{3}{4}$″x$11\frac{1}{2}$″ hardwood stock	block
1	$\frac{5}{16}$″ $\frac{7}{16}$″x7″ hardwood stock	strip
2	$\frac{1}{2}$″ $1\frac{3}{4}$″x$8\frac{1}{2}$″ hardwood	handle pieces
1	1″ $1\frac{3}{4}$″x7″ pine	blank stock holder
4	#8 $1\frac{1}{4}$″ flat head steel screws	
2	#8 $1\frac{1}{2}$″ flat head steel screws	
3	#4 $\frac{3}{4}$″ flat head steel screws	

NOTE: Also need glue and sandpaper.

You need not be banished to some gloomy basement Siberia to do the family wash. This recessed alcove, with folding doors, keeps the laundry "hidden" but in a convenient location.

Laundry Planning in Your Home

The laundry should be located so it relates to your living habits and does not interfere with other activities. At the same time it should keep you out of the basement

A KITCHEN OR BATH oriented laundry can be very convenient, as a number of scientific efficiency studies have adequately demonstrated. However, the merging of two separate activity areas can create wholly new problems. If these are not recognized and solved, the presumed advantages may instead turn out to be long-term headaches.

You should seriously consider putting your laundry near the bath, kitchen or family room. But you should not do so blindly on the mere say-so of well-meaning advisors. Some professed "experts" in laundry planning are demonstrably so faddish about main-floor laundries that they fail to appreciate—certainly fail to communicate—some of the possible short-comings of such designs. Therefore it is largely up to you to plan your new laundry so that it relates in the best possible way to your own living habits. The only way to do this is to think positively and enthusiastically—but with due consideration of all the variables that you can image.

Bathroom laundries. One school of thought is that the bathroom-bedroom area is the ideal location for the laundry. The principle reason: this is where most soiled clothing accumulates, and where clean laundry is stored. By locating the laundry in the bathroom area, there is no need to tote heavy baskets of laundry up and down basement stairs. A second advantage is that the laundry plumbing can be integrated with the bathroom plumbing to save on installation costs.

But there are the possible disadvantages of a bedroom-bathroom location. First, there is the problem of noise. Will the laundry activities and equipment disturb nearby sleepers—perhaps a family members who holds a nighttime job, an elderly person who needs daytime naps, or anyone in the family who may become ill. If so, you may at least have to provide sound-proof walls.

lavatory drains, clogged: see drains
lawn fertilizer: see fertilizers
lawn mower: see engines, small
lawn ornaments: see ornaments, lawn

You may also have to cope with increased dampness in this area of the house because you are combining two wet rooms. More efficient ventilating systems may be required.

Above all, you should view with considerable skepticism such suggestions as putting the laundry inside the bathroom (not just near it), or "in the corner of the master bedroom." Both suggestions are made by design "experts."

Unless you live alone, or are extremely short on space, the bedroom location should be discounted as absurd for obvious reasons. And consider the incovenience and embarrassment that would result when people needing to use the bathroom have to ask that you leave the laundry! Even a partition-separated bath and laundry can be ill-conceived. For example, can you imagine a layout that forces you to walk through the laundry to reach the master bathroom, but only as far as the laundry tubs for the toilet? One appliance manufacturer actually advises professional house-builders that such innovations would enhance their prestige!

In many homes—especially in those having no basement—the bathroom area may be the logical location for the laundry. However, the planning and construction should be such that there will be no conflicts of interest between people using the laundry, bedroom and bath.

Kitchen area laundries. Though some planners argue that dirty socks and soup do not mix, the placement of laundry equipment in the kitchen itself may be feasible if the family is small and wash loads are relatively light. For example, a retired couple living in a small house would probably make out very well with such an arrangement. However, it is generally preferable to separate the laundry from the kitchen with a partition and door.

In many ways, the kitchen area seems better suited for the laundry than is the bathroom area. Certainly the transport of clothes to and from the bedroom-bath area should impose no hardship since there are no stairs to climb and a wheeled cart could be used. There would be no conflict with those using the bedroom or bath. Moreover, time could be saved by coordinating some of the cooking chores with washing operatioins. Finally, plumbing installations would be just as economical here as they would be in the bathroom area.

One widely touted advantage of the kitchen area is that you can remain closer to general family activities while doing the wash. Though this notion can be very true, it is usually offered without qualifications as if it were always true. It is not.

For example, if the recreation or family room is in the basement (or if it may be there at some time in the future), you may discover that the kitchen-oriented laundry is actually separating you from young chil-

Chinese-style laundry with teak-paneled walls and ceiling typifies departure from sterile utility room. Note undulating cabinet doors and wicker baskets that add to exotic mood. Divider wall, at right, separates laundry and kitchen.

Dirty socks and soup do not mix, according to one school of thought, but the kitchen may be a feasible location for the laundry. This kitchen corner instantly becomes a laundry center with the installation of these compact space-saving units.

Automatic portable washing machine is ideal for people without a basement or even those wishing to move the laundry to the kitchen but do not have the room.

dren who play in the basement. A basement laundry would enable you to do the laundry and keep an eye on the children at the same time.

Basement laundries. You should not discard the idea of a basement laundry offhand because it may actually provide the best arrangement in your home. You should ask whether it really makes sense to put the laundry on the main floor of the house if it means that the kitchen, bath or some other room must be made inconveniently small. Perhaps it would be more convenient to have a larger kitchen or bathroom and a larger basement laundry.

The primary objections to a basement laundry are that it forces you to walk 40 percent more on wash days that during other days, and that you must carry heavy laundry baskets up and down stairs. The first objection seems the minor one—except in the case of elderly or otherwise infirm persons. However, the carrying of clothes up and down stairs can be a safety concern. Half of this problem is solved by the simple expedient of installing a clothes chute. The other half could be solved by the addition of a simple dumbwaiter.

Assuming that the construction of a clothes chute and/or a dumbwaiter would make the basement laundry feasible, the choosing of a suitable basement location for the laundry becomes important. Probably, the best place is under the bathroom because the clothes-transport systems would then tie in directly with the clothes-handling area on the floor above. In any case, it should be located under either the bath or kitchen to save on plumbing costs.

The most specious argument offered against a basement laundry is that it forces you to work in a dark room cluttered with dirty clothes and detergent bottles. Less zealous proponents of main-floor laundries admit that a basement laundry—if it is absolutely necessary—can be made "quite pleasant at reasonable expense." The obvious truth is that a basement laundry can be made just as bright, colorful, comfortable and efficient as a laundry in any other part of the house, provided that the base-

ment is dry. Those who have excessively damp basements perhaps have the best possible reason for moving the laundry upstairs.

General planning. Wherever the laundry is located, you should plan carefully to arrange appliances and other laundry features so that work flows in a logical manner. For example, soiled clothes storage (bins or baskets) should be near the soak sink or tub and the washer. The dryer should be close to the washer to eliminate unnecessary travel between them. Ironing equipment should be so spaced and oriented from the washing section that it can used without interference with washing operations that may go on at the same time.

There should be adequate counterspace on which to sort soiled clothes and to fold and temporarily stack clean wash. Also provide some place to hang up clothes that cannot be folded.

Cupboards for the storage of soap, detergents, blueing, bleach and other supplies are preferably placed high enough to frustrate inquisitive children and to eliminate constant stooping. Closed cupboards, of course, look far better than open shelves.

No laundry can be considered really complete if it lacks a tub or at least a sink that can be used for hand washing, stain removal operations and pre-soaking. A double sink or tub is even better. The use of a kitchen or bathroom sink is at best a second-rate solution.

Ideally, a sewing center should be in the laundry, or close by, because needed repairs are often noticed during laundry operations, and are often best dealt with before the clothes are subjected to further washing and drying operations.

And finally, bear in mind that the laundry-sewing area is a work area, and as such deserves bright, modern lighting. Maybe that's the real reason why basement laundries have acquired a bad name; too often the only light in the room is a single 100-watt bulb stuck into a socket between open, dust-catching beams. That's worse than a Siberia—it's a cave. J.H.

See also: ADDITIONS, HOME; KITCHENS; LIGHTING; PLUMBING; VENTILATION.

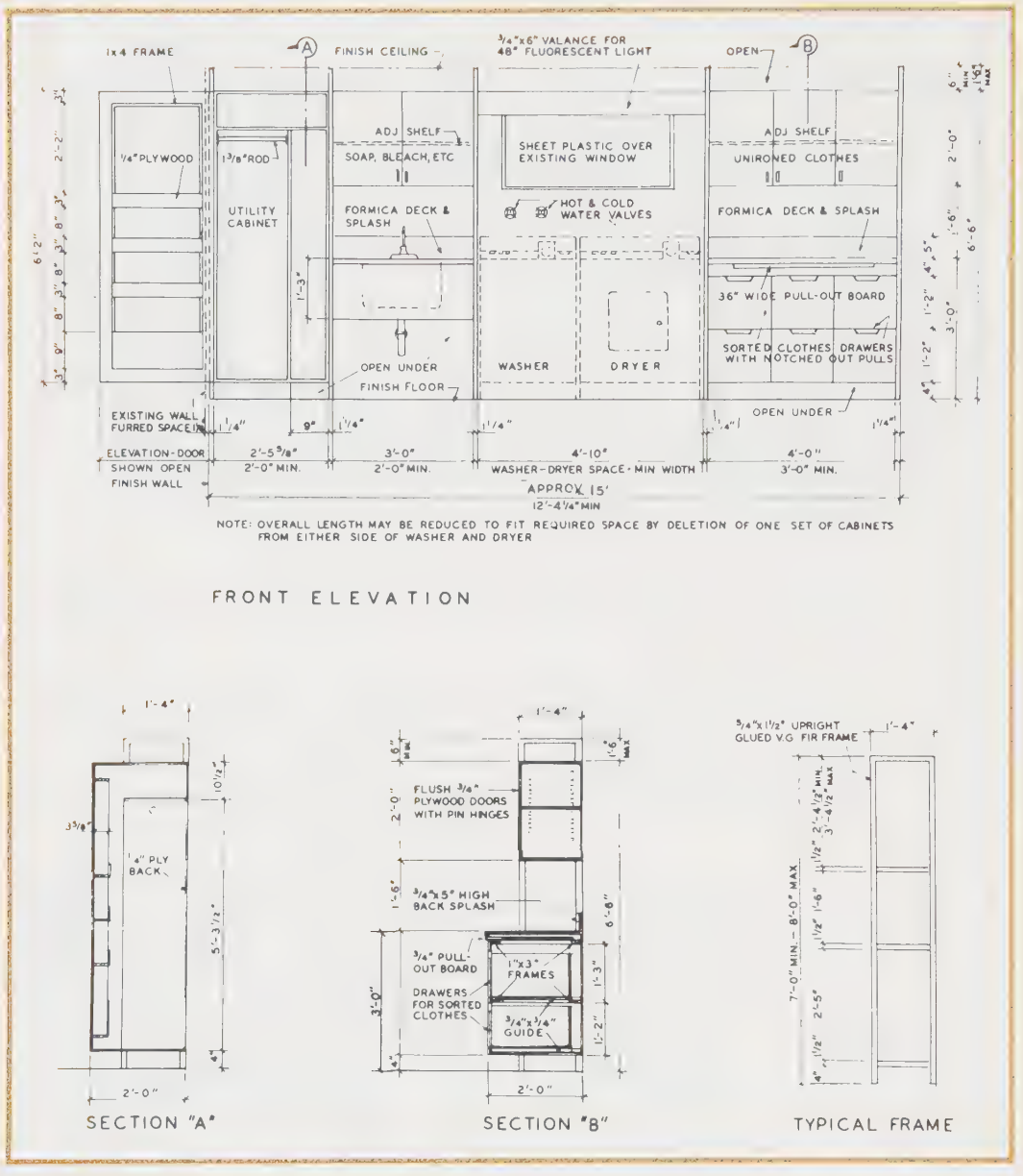
This laundry center can be installed in a small space adjacent to a bathroom or kitchen. When folding doors are closed, the sounds of the laundry are muffled and disturbing to no one.

Build This Modular Laundry Center

The individual modules of this work center can be modified to suit the dimensions of the space you have available

THIS EFFICIENT LAUNDRY center is designed for a basement general activities area, but it would be equally attractive and useful in a room devoted entirely to laundering, as part of a sewing room or as one wall of a main floor family room. Ideally, the center should extend almost fifteen feet in length, but it can be compressd by two feet and still retain all functional components in usuable proportions. If this minimum length of twelve and three-quarters feet is still longer than your available space, either eliminate the ultility cabinet on the left end, or place it elsewhere in the laundry room.

So that you may adapt the basic design to fit your available space, the accompanying Materials List indicates what you need for each module. Thus, should it be necessary to eliminate the utility cabinet, there will be no puzzlement concerning the construction materials that should be scratched from your shopping list. The Materials List is self-explanatory except, perhaps, the plywood quality codes that may be unfamiliar to some. Interior plywood is specified for most applications, but more water-resistant exterior plywood is recommended for the sink area. Where you will want two smooth sides that can be painted but where one side need not be of top quality appearance, A-B grade of plywood is used. Where the appearance of only one side is important because the other side will not be visible (as in the sink apron) a cheaper A-C grade is specified. An A-D grade of ¼-inch thick plywood is adequate for making the rear walls of the cabinets. The DFPA designation that applies to all the plywoods simply means that the products meet specific manufacturing standards. Note that the Materials List does not include ceiling or floor materials, nor does it specify prefinished plywood or other wall-treatment materials.



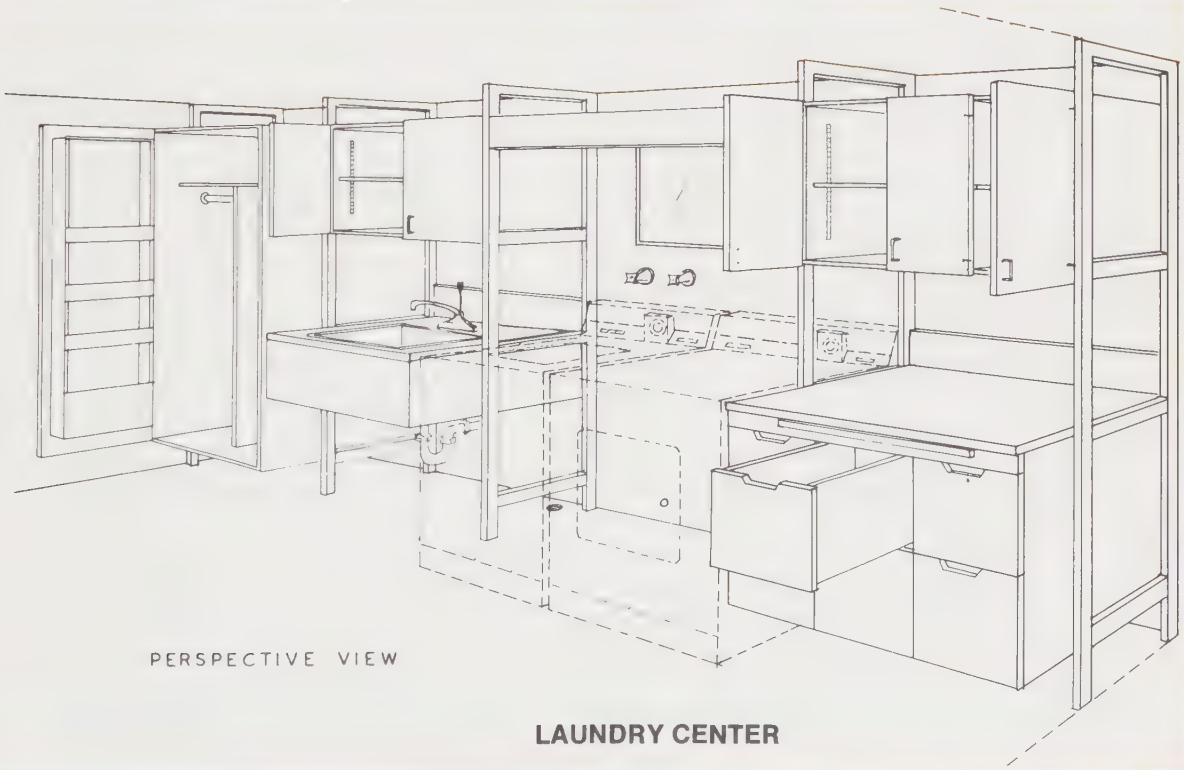
Modular design. This laundry center is an ideal do-it-yourself project for the home handyman of average skill because of the use of a modular design calling for construction of separate cabinet units which are then secured to the supporting frames with eight #8 stove bolts per cabinet; a full size center requires five frames. Start the project by making all five supporting frames, and tack them temporarily in place. You can then visualize easily any minor dimensional changes that may be required, when constructing the cabinets, to tailor them to your available wall space.

Make each frame from good quality fir stock, 1¼ x 1½-inch by 7 or 8 feet long,

depending on the height of your room. Cut four cross pieces, each measuring 13 inches, and attach one between the tops of two vertical members, one four inches from the floor, and the two other pieces as indicated on the frame detail drawing. Use glue, and either screws or nails, but be sure that the frames are sturdy since they will support a fair amount of weight. If in doubt about the strength of the frames, add a few inconspicuous angle irons at key joints. Tack the frames temporarily in place—just enough to hold them upright but loose enough to move if some adjustments become necessary. Make sure that the space allocated to the washer and dryer is at last 4 feet 10 inches wide.

You can construct and assemble the modules in any sequence you wish, but there could be an advantage in starting with the drawer module and working your way from right to left. If you should miscalculate a bit somewhere along the way, you may find it easier to make minor dimensional adjustments on the ultility cabinet than on the more complex drawer assembly.

Drawer module. Study the front elevation, perspective view and section B thoroughly before building the drawer unit. Note that the height of the drawer module is 32 inches including the Formica or other plastic laminate top. However, the countertop will be a full 36 inches above floor level because the module is raised four inches off the floor. The unit is two feet deep (but the top has a slight additional overhang toward the front only). Length can be three to four feet, depending on the amount of space you can allocate to this



LAUNDRY CENTER

module. Since no one set of dimensions would be universally applicable to all home laundry areas, no detailed dimensions for the drawers are provided. The best dimensions for your laundry center will become obvious when the box encasing the drawers has been constructed. Start by cutting the plywood top, two end pieces and the bottom panel (1½ inches shorter than the top panel) from ¾-inch plywood. Assemble these and the back panel made from ¼-inch plywood to form an open-front box.

Note that there is provision for a pull-out board (36 inches wide in the full size module) located just beneath the counter top. It slides out through a slot cut into the top front trim piece which is about 3¼ inches high. After adding the trim piece and pull-out board, cut a ¾-inch plywood panel to completely cover the open front of the box. By cutting the panel into six pieces of equal size and shape, you have the makings of the drawer fronts. Hand notches on the top edges serve in place of handles. Make the three bottom drawers first, starting with the one on the lower right. Note that the bottom panel should go just high enough to leave a lip on the front panel that will hide the edge of the bottom board of the box; similarly, the right side of the drawer is located away from the drawer edge so that the drawer front overlaps the side panel of the big box. After making this corner drawer, you can make two more just like it to complete the bottom row. After putting these drawers in place ¾ x ¾-inch guide strips nailed to the floor of the box, you can easily determine the correct positioning of the framework that supports the upper drawers. Since the supporting framework is made of 1-inch stock, drawers having the same ¾-inch bottom edge extensions as those used in the lower row would leave a gap of ¼-inch between the bottom and top edges of the drawers in the two rows. You can close this gap a bit, if you like, by making the top drawers just a mite shallower than those used on the lower level.

Formica or other brand of plastic laminate countertop material is used to surface the counter; left-over pieces can be used on the backboard. Mount the completed module four inches above the floor, between the two right hand frames. Pre-paint the modules and the frames before assembly, especially if the frames are to be a different color.

The upper cabinet, intended for storage of unironed clothes, will be far easier to construct. It should be the same width as the lower unit, two feet high, and the same total depth (16 inches) as the supporting framework. The flush ¾-inch thick doors are mounted with pin hinges. Note that the plans calls for use of three doors and one adjustable shelf. After bolting this module in place so that its bottom is 18 inches above the top of the lower module, you are ready to move on to the next section.

Washer/dryer section. If you already have on hand the washer and dryer that will be incorporated into the laundry center, you need only move them into place and set up the third frame. Connect the second and third frames with a 6-inch high valance, made of ¾-inch plywood, to shield a 48-inch fluorescent light. If you have to purchase one or both of the appliances, make this section at least 58 inches wide. Of course hot and cold water valves, drain systems, and dryer outlet should be provided before the appliances are installed. The optional sheet plastic over an existing window is suggested in the interest of diffuse lighting and general eye-appeal. If you have a similarly oriented window, and wish to add this touch, mount the plastic so that it will not interfere with opening the window to provide ventilation.

Sink area. The simple plywood box containing the sink is made of ¾ and ¼-inch exterior plywood, because this grade is

more resistant to water than interior plywood. Interior plywood is fine for the upper two-door cabinet. This sink area should be at least two feet wide, preferably three feet. A plastic sink with Hudee rim is suggested. In any case, choose the sink before making the module that will contain it. The sink deck and splashboard is surfaced with the same type of plastic counter material used on the drawer module. Mount this module so that the top is three feet off the floor. Note that the underside of the sink module need not be closed in.

The cabinet used for storing soap, bleach and other laundry supplies is made the same way as the other cabinet in the right hand module, except that it has only two doors.

Utility cabinet. This is designed for storage of such items as an ironing board, floor polisher, brooms, and all sorts of smaller items that will fit on the top shelf or into the four shelves on the door.

The overall dimensions of the cabinet, including the door, are: depth, 2 feet; height, 6 feet 2 inches; width across the front, 2 feet or more as space permits. The sides, bottom and top are made of ¾-inch plywood and the back is of ¼-inch plywood. The interior vertical partition and shelf are also ¾-inch plywood. A clothes pole may be added to the wider section, if you prefer to use this compartment for hanging clothes.

To the inside of the door, which is made of ¾-inch plywood, add a shelf frame made of 1 x 4-inch stock. The outside of the frame should be about 3 inches from

MATERIALS LIST

Quantity	Size and Description	Purpose
3	¾" 4'x8' interior A-B plywood	utility cabinet
1	¼" 4'x8' interior A-D plywood	utility cabinet
2	1⅜" dia. clothes pole	utility cabinet
2	plastic escutcheons	utility cabinet
2 pr.	2"x2" surface hinges	utility cabinet
1	¾" 4'x8' interior A-B plywood	upper cabinet and sink cabinet
1	¾" 4'x6' exterior A-C plywood	upper cabinet and sink cabinet
1	¼" 2'x3' exterior A-C plywood	upper cabinet and sink cabinet
1	36"x36" plastic laminate	sink cabinet
1	¾"x7½" fir	valance
3	¾" 4'x8' interior A-B plywood	unironed clothes cabinet and drawers
1	½" 4'x8' interior A-B plywood	unironed clothes cabinet and drawers
1½	¼" 4'x8' interior A-D plywood	unironed clothes cabinet and drawers
1	36"x48" plastic laminate	drawer cabinet
3	1¼" 1½"x7' or 8' fir	each frame

NOTE: Also need plastic sink and rim, mixing faucet, sink trim, shelf standards and supports, cabinet pulls, magnetic catches, cabinet pin hinges, contact cement, #8 stove bolts, glue, nails and finishing materials.

the door edges. Add four shelves into this framework, as shown.

Building tips. Do not saw your plywood indiscriminately, but lay out the component parts carefully to minimize waste. Be sure to allow for the width of the saw kerf between adjacent parts, or you will be cutting the components a little too small. For hand sawing use a 10 to 15 point cross-cut saw —a sharp one. A saber saw or coping saw can be used to cut curves. Mark the plywood on the best side if you will saw by hand or with a bench type power saw. If you use a hand held power saw, turn the plywood over and mark it on the poorer side. Use a plywood blade for smoothest cuts and best joints; a combination blade will, however, do a reasonably good job.

When drilling bolt holes with a brace and bit, drill from one side until the drill point breaks through, then complete the drilling from the other side to prevent tearing of the wood. Always plane plywood edges from the ends toward the center, with the plane blade set for a shallow cut.

Only a minimum of surface sanding of the plywood is necessary, using 3-0 sandpaper and working in the direction of the wood grain. Use 1-0 sandpaper to smooth plywood edges before applying a sealer or flat undercoat.

To obtain an A-1 job, use glue at all joints. If you nail, choose 6d finish nails to hold ¾-inch plywood and 1-inch brads to hold ¼-inch plywood. If the nail heads will not show, as on the back panels of the modules, use 1-inch blue lathe nails to hold the ¼-inch panels more securely. You can, of course, alternatively use screws. Always pre-drill for the screws, and use the following sizes: #8 x 1½-inch wood screws for ¾-inch plywood; #4 x ¾-inch screws to hold ¼-inch plywood.

Painting. Either water-base or oil-base paint may be used to obtain a flat, semi-gloss or gloss finish on the modules. If you select water-base paint, first seal the plywood with clear resin sealer or oil base primer. If you use an oil-base paint, apply one coat of the kind of primer recommended by the paint manufacturer, and follow with as many coats of finish paint as needed to achieve a first-rate appearance. Don't rush the job; allow each coat to dry thoroughly before adding another coat.

General suggestions. Ideally, this laundry center is constructed on one wall as shown, but in a small room this may not be possible. Rather than eliminate one section, consider redesigning the unit to make use of two adjacent walls—perhaps placing the washer/dryer section and the drawer module on the right wall and the sink and utility cabinet on the adjacent left wall. Just be sure that the sink can be used even if the washer door is open. There would be no problem with a top-opening washer. If you have a front-loading washer, perhaps switching the washer and dryer positions will provide adequate standing space before the sink. Of course the dryer door would then have to be closed, but this arrangement would be safer because there would be less chance of water spillage from the washer to the section of floor before the sink.

Long before you start work on the modules, you must of course plan and provide all necessary water lines and drain systems. Also a vent pipe for the dryer, and any new electrical wiring (use grounded outlets). Do you need some sort of pump to raise waste water to a drain pipe above floor level? Don't forget to make provision for it.

This laundry center is equally efficient whether it is placed against a paneled wall or a painted masonry wall. But if you want a real eye-catcher laundry, spend a few more dollars for wall paneling to set off this handsome and highly functional work place. J.H.

See also: ADDITIONS, HOME; KITCHENS; LUMBER; PLUMBING; VENTILATION.

Choosing and Maintaining a Lawn for Your Yard

Even if you are a beginner, you can have a beautiful lawn if you follow the proper procedures for selecting seed, planting and general care

Well planned lawns are useful and decorative. The proper choice of lawn size, design and type offers many advantages. It can unify a garden, provide year-round greenery and an area for play or relaxation. Choose the right grass for your climate.

MORE THAN 1000 KINDS of grasses can be found in North America. The list includes such obvious members as range grasses and more remote ones such as corn, sugar cane and bamboo. Less than forty are used as lawns and those have one factor in common: even a first-time gardener can be guaranteed good results with a few simple rules.

Lawn grasses are commonly divided into two groups, cool-season and warm-season or subtropical grasses, the primary difference being their response to temperature. To insure the best possible lawn, choose the right grass for your area. While there is no exact dividing line, the break occurs somewhere around the Mason-Dixon line in the east and central Utah, Nevada and California in the west.

Types of grasses. Warm-season grasses, such as Bermuda, St. Augustine and zoysia thrive in the heat and reach their maximum growth in late spring, summer or early fall. Most will not survive a winter in the northern areas.

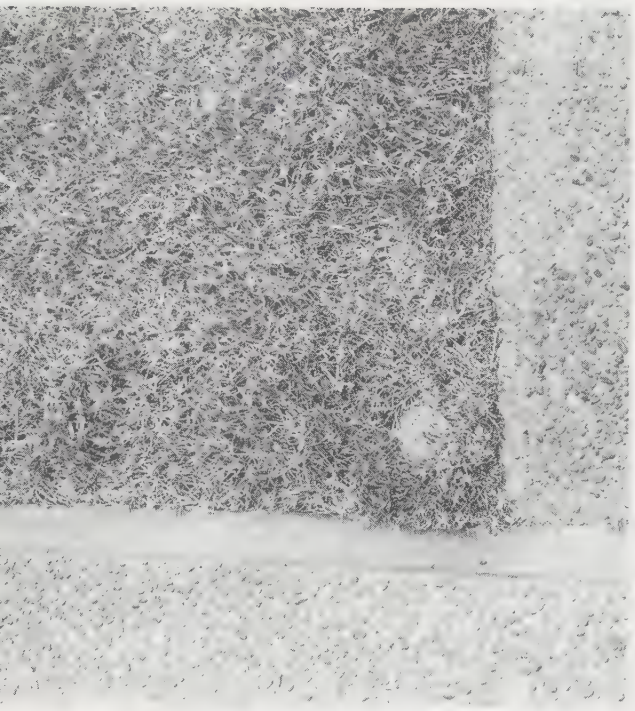
Subtropical grasses are primarily used in deep South areas and should be planted in the spring (before June 30).

The grasses are sold four ways: in flats from which you cut plugs, in rolls ready to slip into prepared areas, in bags as sprigs (that is, separated runners), or as squares with the dirt removed. Bermuda grasses are the only subtropical types from which seed is commonly packaged.

Most of the hybrid Bermudas cover faster from runners than zoysias. Exaggerated advertising claims held back zoysias when they were first introduced, but they are good grasses and you should consider them. They are dense and tough though slow-growing (most require two or more years for full development). Their only real drawback is winter dormancy.

Cool-season grasses like Kentucky blue-

lazy susan: see trays
lenses: see science projects
levels: see hand tools
library wall cabinet: see cabinets
light dimmer: see dimmer, light



Mowing is important, and to help reduce work, add mowing strips when transitions are required. Above, wood makes it easier to mow close without much hand-trimming.

grass, fescues, bentgrass and rye grow best during the cooler seasons and usually come up best from a fall sowing in September or October, in most areas of the country. They are semi-dormant, although green year around, and grow slowly during the summer months.

Your lawn will only be as good as the seed. If the mixture contains undesirable strains, the lawn will be blotted with annual grasses that leave bare spots in the fall and winter, or with species highly susceptible to damage. When patching and renovating, be sure to identify and to match grasses for a uniform appearance.

For lawn areas that are in full sun, the bluegrasses are preferred in northern areas and zoysia, St. Augustine, Bermuda, or dichondra for the southern areas. Merion Kentucky bluegrass is the superior species for northern weather conditions, but Delta and Newport are satisfactory. Meyer zoysia and U-3 Bermuda grasses are preferred for southern climates.

Use a fine fescues when turf grass is needed in shady or semi-shady areas. The preferred species of Creeping Red fescues are Pennlawn, Illahee, and Trinity.

Avoid the bentgrasses for general lawn use. They require high maintenance and close-mowing and are not generally recommended.

A small percentage of annual grasses such as *Poa trivialis,* redtop, and rye-grass are sometimes used in seed mixtures to give quick temporary cover until the perennial grasses take over, but these species should never exceed 3 to 5 percent of the mixture.

Plan the lawn to avoid terracing, since terraces are difficult to maintain. When a lot slopes steeply, try retaining walls instead. Be sure the soil slopes gradually from the house, walks and driveways to insure that water will not stand in pools. It may be necessary to install drain tiles when natural drainage will not remove excess water, or when the water table is near the surface. It may also be necessary to install drain tiles when large trees are present.

Protect trees from root suffocation if the new lawn is to be considerably higher than the existing level. Build a brick or stone well around the tree 3 to 5 feet larger than the diameter of the trunk.

If you have a problem lawn that you must remove before you can make a fresh start, it may not be necessary to dig an entire area or cover a yard with new topsoil. There are chemicals available that can be applied to destroy the old lawn. Two are cacodylic or methyl arsinic acid. You are ready for a new lawn within a week or so after application.

In this case, distribute the new seed into the uncultivated ground. No tilling or digging is needed, but the watering has to be constant and careful to get the seedlings

started. Mulch lightly, using a finely ground material such as peat moss, to retain moisture.

Preparing the soil. Break up the soil to an even depth (six inches or more if possible) with a spade or power tiller. The lawn bed should be free of large clods and rocks and you should remove burried objects because they can interfere with the penetration of water. Remove annual weeds with a hoe and dig up perennials by the roots. Do not turn them under as most take several months to decay. To determine exactly how your soil measures in acid or alkaline content test it with a soil-testing kit or with a sample sent to a laboratory. Most state universities will interpret a test for a minimal fee and many nurseries offer a similar service.

If your soil is overly acid (a pH below 5.5) neutralize it with an application of agricultural lime at the rate of 50 to 80 pounds per 1000 square feet. Calcium nitrate has a similar effect but requires more material and may be more expensive.

If your soil is essentially alkaline, you can reduce alkalinity and improve soil content with several products. Gypsum is one of the most common and is extremely safe. Simply spread an amount on the soil and dig it in. 30 to 60 pounds per 1000 square feet is usually adequate.

When a soil is deficient in nutrients, add phosphorous and potash for deep root development. About ten pounds of phosphorous for each 1000 square feet of area is adequate. Dolomite ground limestone, which contains both magnesium and calcium, should be added to land low in magnesium. If your soil is a clay or compacting type, add a conditioner such as pumice, perlite, vermiculite, or peat moss. Add peat, well-rotted manure, or decomposed sawdust to sandy or gravelly soils. Clay may also be added.

Spread a 4 to 6-inch layer of topsoil uniformly over exposed subsoil and if additional topsoil is needed, buy with caution. Some is actually subsoil and others may contain toxic salts, noxious weeds, or undesirable plants.

Tilling operations should be done under normal moisture conditions. Do not work when the soil is wet. The best methods of preparing soil for planting are plowing or spading, followed by disking and raking. Excessive rototilling tends to "float" the finer soil particles to the surface and the beating action of a tiller may destroy some of the soil structure.

The surface should be left slightly rough. Moderately coarse soil particles make the best seedbed by providing crevices in which seed can lodge and be sheltered. Allow the bed to settle, then sprinkle thoroughly. High spots and depressions can be smoothed by raking.

The lawn here provides contrast between the lake in the distance and the patio.

MOST ASKED LAWN QUESTIONS

How often should I fertilize a lawn? If using a standard fertilizer, monthly; if using a so-called "long-lasting" type, three or four times a year. Once a year if using one of the new vigorous types.

Should I use lime yearly? Unless soil tests indicate otherwise, yes.

How often should my lawn be watered? When no rain falls, weekly. The soil should be moistened to a depth of six inches—which usually means a sprinkler should operate two to four hours.

What is the best mowing height? For the healthiest lawn, mow fescue and St. Augustine at two inches—approximately weekly—and sweep the lawn monthly. Mowing these grasses too short, for example an inch or less, or allowing them to grow excessively, as to four or six inches, then cutting back, weakens the lawn and may invite crabgrass. Bentgrass, zoysia and Bermuda lawns are best mowed to one inch height.

What grass should I use in a shady area? If heavy, all-day shade—none. Try a ground cover instead. Two suggested species are vinca and pachysandra. If partially shaded you may be able to keep grass with careful watering when shade comes in the afternoon. If the area is shaded only in the morning, your lawn may last only a year or two.

Should I add seed to an existing lawn? No, it rarely does any good and a few seedlings survive more than a few days. Instead try extra fertilizer since existing grasses can produce a dozen or more new plants when encouraged by extra food and water.

How do I cover bare spots? Fill in with pieces of sturdy sod cut from the edge of your lawn. Forget seeding. It won't work.

TYPES OF FERTILIZERS

Organic—At one time the term meant a "natural" nutrient as compost or manure but now it commonly refers to urea, a man-made chemical that is generally harsh-acting. Natural organic mixtures are slow-acting and will not burn even when applied heavily but in comparison chemical "organics" can damage gardens through burning even though a label states "non-burning."

Farm—Generally an inexpensive, fast-acting fertilizer which is often used to "green-up" lawns speedily. Some types are caustic and can burn unless watered frequently. The feeding power usually disappears quickly, sometimes within a few days.

IBDU—A continuous feeder which may release nutrients for prolonged periods. Some versions are recommended for quarterly feedings and others may last as long as one full year.

Ureaform—Until recently the only true long-lasting fertilizer available. Still highly recommended it depends on soil bacteria to decompose and is expensive. Generally a component of quality mixes.

All-purpose—A general utility mixture suitable for lawn and garden applications. Recommended for the initial fertilizing start that helps to bring plants to the flowering stage. Remember that many plants produce more flowers or fruit when they are not fertilized after reaching the budding stage.

Quick fertilizer—An instantly dissolving powder recommended for a speedy pickup at transplanting or when a garden or lawn seems off color. Quick fertilizers are "hot" and should be used with care. Follow the manufacturer's instructions explicitly to avoid burning. Ideal for emergencies but too costly for regular use.

Weeder and Feeder—A mixture formulated to combine a feeder and weed killer. The feeder is designed to encourage grass to fill in as the weeds disappear. Most mixtures are compounded for use on lawns only and special formulas are generally required for dichondra.

Special Compounds—Includes custom fertilizers for roses, azaleas, camellia, avacado, citrus and other plants. Order specific mixtures from your nurseryman.

Contrasting grassy areas with other elements, such as concrete, adds a touch of drama.

Planting. Seed may be distributed by hand or with a mechanical seeder. The latter is preferable to achieve a uniform distribution. Mechanical seeders may be rented from nurseries, lawn supply and hardware stores. Divide the seed into two equal parts and sow one part in one direction and the other crosswise to the first sowing. If you are using a good seed (and you had better be if the project is to be worthwhile), do not be too generous. A little bluegrass goes a long way with over two million seeds to the pound. Not every planted seed will survive, but a single bluegrass plant can spread runners an amazing distance.

Cover the seed lightly with careful raking then firm the area lightly with a roller and mulch with a light covering of weed-free straw or hay to help hold moisture.

Keep seedlings moist until well established. Light and frequent waterings are required during the early stages, but avoid saturating the soil. Excessive moisture promotes fungus diseases.

You can expect to see the beginnings of your new lawn in a week or two. Keep up the sprinkling while the young grass takes root and start mowing when the new lawn reaches twice the customary mowing height.

Lawn care. Fall feeding is the most critical part of any program. The fall is the season when cool-season grasses like bluegrasses, fescues, and bents have the most favorable conditions. The days are warm and the nights cool and moist. Annual weeds have died out and frost will soon kill any lingering weeds, leaving the nutrients and the space for grass.

The amount and kind of fertilizer depends on the turf. A good rule of thumb for the annual nitrogen requirement is to use one pound of actual nitrogen (N) per 1000 square feet for each growing month. Apply two-thirds of this amount in the fall and one-third in the spring. Bluegrass and fescue mixtures (for sun and shade lawns) require about 4 to 6 pounds of actual nitrogen per 1000 square feet each year.

Merion Kentucky Bluegrass (for sunny lawns) annually requires 6 to 8 pounds of N per 1000 square feet. Pennlawn Red Fescue (for shady lawns) requires 2 to 4 pounds of N, and Creeping Bent requires 6 to 8 pounds of N annually.

Proper fertilization of these turfgrasses

can now be handled with a minimum of yard work, since the introduction of non-burning ureaform fertilizers that release the nitrogen slowly. In the "old days," with only the fast-acting fertilizers, it would have taken up to eight applications to put down 8 pounds of nitrogen per 1000 square feet without danger of burning a bluegrass lawn. Today your garden center can supply a balanced fertilizer and you can be certain the nitrogen will always be there in an amount the grass can use.

Soil tests should be taken at least once every two years and, remember, regular liming to keep the pH about 6.5 is essential to get the maximum benefit from fertilization.

Mowing. The first requirement for any well-mowed lawn is a good mower properly maintained. Keep the blades clean and the machine properly oiled. Keep small tools on hand for tightening loose bolts.

Keep the lawn clean. A layer of leaves reduces the amount of light, air and water the grasses get. Before mowing, remove these with a light rake or with water. Always weed before mowing since some weeds—dandelions and morning glory are two—develop stronger root systems after their tops have been cut. Lift the weeds out with a weeding tool then tamp the disturbed grass around the area.

When you begin mowing, mow first in one direction then a second time at right angles to the first cut. The two-stage system virtually guarantees a smooth, even-textured surface. Use the grass catcher for the first mowing but not for the second cut and let the mower overlap a few inches on each cut. New lawns should be cut when the grass is three or four inches tall with the mower blade set for a two-inch cut. Roll new lawns the day before cutting to firm delicate roots which might otherwise be pulled loose by the blade.

After mowing, edge the lawn with clippers, a special edging mower or shears. When the grass has grown unusually tall, as it can around trees, it can be cut with a sickle.

See also: FERTILIZERS; GARDENING; GARDEN PLANNING; LANDSCAPING.

In full sun, try bluegrass in northern areas, zoysia or the like in southern areas.

Buying the Right Grass Seed for Your Lawn

Evaluate the use of the lawn, its planned appearance, your climate, and location of the lawn in relation to the sun in order to choose one of the many kinds of seed on the market today

A WELL-KEPT, ATTRACTIVE LAWN can provide a recreation area for your entire family, a place for you to relax and enjoy the outdoors or an aesthetic showcase to frame and enhance your home. No matter how you use your lawn, it will take time, effort, and money to establish and maintain it—and your investment in all three can be wasted if you do not know how to choose the proper lawn seed.

Before buying lawn seed, ask yourself How the lawn will be used (decoration, recreation)? How you want the lawn to look? Which kinds of grass grow well in your part of the country? Will the lawn be in the sun or shade? and How much time and expense are you willing to put into lawn care? Not until you have answered these questions can you buy the most suitable grass seed.

There is a great variety of seed available on today's market, so learning the characteristics of each one and where they flourish is imperative.

Used widely in the South, common Bermuda grass should be planted in the sun in a well-drained soil. You can plant it in soil of high acidity and low fertility.

Blue grama has the advantage of being highly drought resistant, so it is recommended for use in cool, dry areas such as the Great Plains where there is only a small amount of rainfall and little or no irrigation. A naturally short grass, it will not stand up to heavy traffic. Buffalo grass is also drought resistant, but it requires a slightly heavier soil than the blue grama.

Carpet grass is used in the South and grows best in moist, sandy-loam soils. It produces a coarse, compact turf, but its seed heads are very hard to mow.

Commonly associated with red fescue, Chewings fescue grows best in cool, humid regions of the United States. It adapts well to shade and dry sites.

Colonial bentgrass, used in high quality lawns, is popular in the Northeastern States, Washington State and Oregon. It needs frequent fertilizer applications and mowing; in general, a bentgrass lawn requires a tremendous amount of maintenance.

Kentucky bluegrass is the most popular lawn grass in the Northern United States. It is hardy and can be used for play areas and athletic fields. Growing best in a cool, humid climate, it is fairly drought resistant. It should be planted in the sun and in soil with good drainage and low acidity. Regular fertilizing and liming are required. Merion, a variety of Kentucky bluegrass, is also used throughout the Northern United States. It should be planted in highly fertile soil and responds well to high applications of nitrogen in fertilizer.

Having wider leaves, perennial ryegrass is recommended for use in medium to highly fertile soil in the Pacific Coast, Central, South or Atlantic states. It is generally used for temporary lawns. Some fine-leaved varieties have come onto the market and seem to grow into a more attractive patching.

Red fescue is used in cool, humid regions of the United States and grows well in shaded, well-drained areas. It is usually planted in a mixture with Kentucky bluegrass.

Rough bluegrass is injured by hot, dry weather, so it is grown successfully only in cool, moist climates. It should be grown in shady areas where traffic is on the light side.

Tall fescue is grown mostly in the mid-southern belt of states for lawns or playgrounds and atheletic fields. It can withstand both summer droughts and high temperatures. Forming a tough, coarse turf, it grows in bunches if seeded too sparsely. A good seeding rate is six to eight pounds of seed for every 1000 square feet. This grass has a poor appearance when blended with fine-leaved grasses.

Regardless of the type of seed you choose, make sure you read the label on the package carefully. Federal and State seed laws insure you that the label will bear truthful and adequate information about the quality of the seed.

The Federal Seed Act insures that seed sold across state lines is labeled correctly. It requires specific labeling on seed containers and prohibits false labeling or false advertising.

On fine-textured or coarse lawn seeds, labels must identify kinds of seed in a mixture as either fine or coarse. This makes a difference in the quality of your lawn and actual quantity of the seed you buy. Fine grasses—with their narrow leaves—provide a carpet-like lawn, while coarse ones —which tend to grow in clumps, have wider leaves and coarser stems—are ideal for hard-wear areas. There are more seeds of fine grasses to the pound. For example, about two million seeds of Kentucky bluegrass as opposed to 225,000 of the coarse kinds, tall fescue and annual ryegrass.

Labels must also state the name of each kind of seed present and the percentage of each.

A variety is a subdivision of a kind. For example, Merion and Windsor are varieties of Kentucky bluegrass. If the variety name is given, the percentage of that variety must be stated in the labeling. The Federal Seed Act requires that if seed is labeled as to the variety, the variety name must be correct. You should select only varieties recommended for use in your area.

Germination is the percentage of seeds

expected to produce normal plants under favorable conditions. Check the time when the seed was tested for germination because the seed loses its ability to grow or develop as it ages. Generally under normal conditions of handling, the germination percentage is considered reliable up to six months after testing.

Each state has a list of seeds that it considers "noxious," or objectionable. These seeds, if present, must be listed on the label and the rate of occurrence of each must be stated. This rate must not exceed permissible limits established by the laws of each State. Incidental seeds of kinds or varieties not named on the label must be listed as to percentage.

Seed contains various amounts of chaff, dirt and other matter not removed in cleaning. The label must show this percentage as inert matter. This, too, will affect the amount of productive seed you are actually receiving when you buy a container of seed.

Most lawn seed must conform to these requirements of the Federal Seed Act if it is marketed across state lines. All 50 states also have laws which require labeling of seed containers and these state laws contain labeling requirements similar to those of the Federal Seed Act.

Experts sometimes recommend a mixture of different kinds of lawn seeds rather than a single kind since one kind of seed might suffer from a disease, while another one might not be affected. Intermixing of kinds of seed may reduce spreading of disease.

Sometimes a coarse grass, like annual ryegrass, is included in a mixture of fine-textured grasses. The coarse grass grows faster and can provide a temporary protective covering until the fine-textured grass matures. The kinds of permanent grasses in a mixture should be compatible in growth habit, care, and appearance.

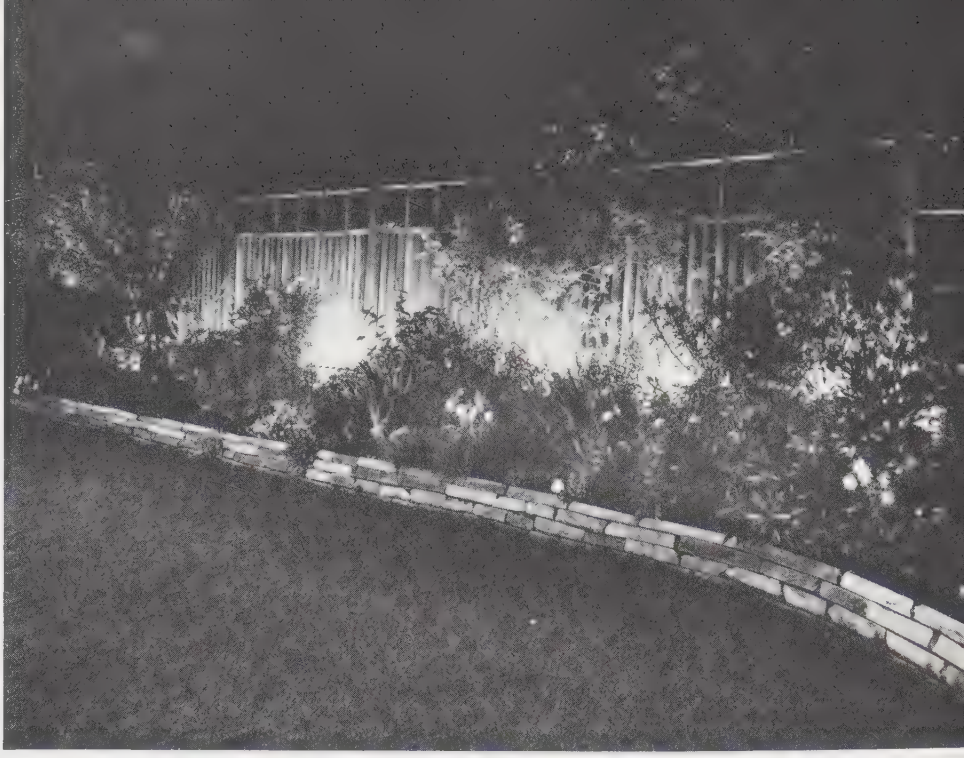
Bargain seeds may be quite expensive in the long run because what may appear as a

bargain to you may produce a coarse, ugly lawn. The price you pay for good seed of preferred kinds and varieties is a small price to pay for a beautiful lawn, considering the few pounds usually needed to seed an ordinary sized lawn.

Fine-textured lawn seed is usually more expensive than coarse-textured seed. However, while you may be paying more for a fine-textured seed, you are also getting more seeds per pound.

One way to tell if a particular seed is worth the price is to compute the actual value of the seed you are considering. Do this by multiplying the percentage of pure seed by the germination percentage. Then divide this result into the actual cost per pound. For example, seed costing 90 cents a pound, with 80 percent germination and 85 percent purity, gives this result: 80% X 85% = 68% pure-live seed. Dividing 90 cents by 68% you get the cost per pound of pure-live seed—$1.32. M.E.F.

See also: GARDEN PLANNING; LANDSCAPING.



Garden lighting can pay dividends in pleasure without pinching your pocketbook. A few dollars for bulbs and holders can produce a colorful scene in backyard garden areas.

Increasing the Beauty of Your Garden with Lighting

Any home garden takes on exciting and dramatic dimensions when a lighting system is installed to enhance the scene

THE RIGHT TYPE of garden lighting can add surprising dimensions to any garden by creating an unexpected sense of drama and decoration. In short, garden lighting is essential today, a wise investment in safety, security and beauty, and no garden should be without at least a basic system.

Gas lighting is generally installed by professionals, while electrical systems can be installed by someone without much training. You can choose from two systems, standard 120-volt lighting or the 12-volt lighting discussed here.

The 120-volt lighting is traditional and proven with a good selection of fixtures. Older gardens generally use 120-volt systems and the reliability of the system is proven. But the relatively high voltage can be dangerous, complicated and costly.

Since 120-volt installations require city or county permits, check with local building departments, before beginning, to see what the regulations and approved materials are. Electrical requirements vary across the U.S. and are generally flexible in areas of underground wiring. Some regions accept direct burial cable while others will only approve a more costly metal conduit.

Use heavier gauge wire for safety. Try 12 and 14 gauge for lines up to 100 feet and loads to 1,450 or 1,500 watts. Use 10 or 12 gauge wire for longer lines and loads to 1,950 or 2000 watts. To protect against accidental damage, bury the wire deeply;

lighting, fluorescent: see fluorescent lighting
lighting, kitchen: see illumination
light sensor alarm: see alarms, burglar
linoleum block prints: see print making
little red barn: see garden tool shed

and when garden cultivation is expected, attach the wire to a flat board, then bury the board with the wire down. Do not cover underground wiring until it has been checked by an electrical inspector. When lines are above ground, use metal conduit and waterproof outlets and switches.

The use of 12-volt current, like that in your car is completely safe; even direct contact cannot harm a human being. Installations are so simple, an inexperienced gardener can create a beautiful system easily. Neither city nor county permits are required and the fixtures are small, lightweight and easily camouflaged. Several can be operated for pennies a week. The selection of fixtures is limited and the number that can be used on one circuit is restricted, but, despite such drawbacks, 12-volt lighting is ideal for the do-it-yourself gardener.

The center of a 12-volt system is the transformer. It reduces 120-volts to 12 and plugs into any 120 outlet without complicated connections. Transformers are available in sizes from 72 to 300 watts. The size controls the number of fixtures and the length of wire which can be used. A 72-watt model is limited to 100 feet of wire and three or four lights. It makes sense to order a larger transformer even when you do not immediately need its capacity, and a 126-watt size is adequate for an average installation.

This simple scene, only one plant and some stones, takes on an awesome beauty with the installation of one strategically placed light.

Up-lighting from several sides provides soft light on graceful weeping willow branches surrounding sunken pool. Underwater lights focus attention on water lilies.

For added safety and attractiveness, two 150-watt lamps are mounted high on side of house. Open-type flood lights should be mounted above ten feet if possible. Otherwise louvered, deep-shielded fixtures should be used. Mushroom fixture serves purely as decorative lighting.

▲ *Small pool adds focal point to garden and can be illuminated by low-voltage lamp in watertight socket secured at bottom of pool. Large rock shields light source. Ceramic frog and surrounding foliage brought into view by 40-watt border light fixtures.*

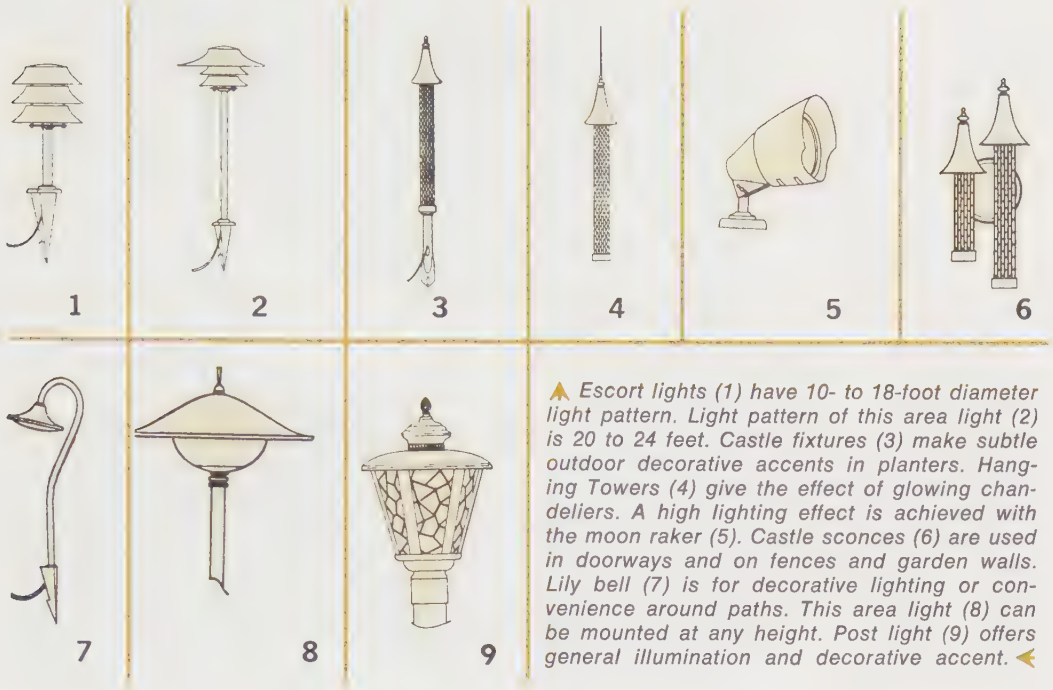
▼ *Homemade lighting systems, such as this one, add form and depth to your backyard gardens. They are not hard to do and with a little imagination, you can create a custom lighting system which is perfect for your situation.*

A transformer can be mounted beside a 120-volt outlet, but performance is best when the main lines, those carrying 12-volts from the transformer to fixtures, are short. Some voltage is absorbed by the wires and shorter lines reduce the loss measurably. It is better to use two short lines than one longer one, but short lines are often possible only when the transformer is mounted a substantial distance from the 120-volt outlet. The installation is preferred since a remote transformer mounting has its own lead-in and since the length of the wire between the 120-volt outlet and transformer has no effect on the 12-volt operation. Most transformers are weatherproof when installed as directed by the manufacturer. So, for best results, follow directions.

The 12-volt system can be controlled by plugs, switches or automatic timers. The simplest approach is to plug and unplug the transformer, but switches and timers are obviously better. Switches can be installed before the transformer in the 120-volt line, or after it in the 12-volt line. A switch after the transformer will need a relay and "door bell" wiring. If you are not familiar with the basic mechanics let a professional electrician install the controls.

If you prefer a switchless system, try automatic controls. Many transformers have built-in timers which can be adjusted to turn lights on and off at any hour you choose. Some types can be programmed for one full year, automatically adjusting the on-and-off times to coincide with the daily variations in sunset and sunrise. Photoelectric cells will do a similar job, but instead of reacting to time they react to light.

The 12-volt main lines resemble appliance cord but have a heavier weatherproof covering. Bury these below the normal garden cultivation depth—six inches is minimal. Bury the lines beside walks, planters or pipe lines to reduce the danger of accidental damage, and when crossing lawns, do it invisibly. Use a flat shovel. Push the



▲ *Escort lights (1) have 10- to 18-foot diameter light pattern. Light pattern of this area light (2) is 20 to 24 feet. Castle fixtures (3) make subtle outdoor decorative accents in planters. Hanging Towers (4) give the effect of glowing chandeliers. A high lighting effect is achieved with the moon raker (5). Castle sconces (6) are used in doorways and on fences and garden walls. Lily bell (7) is for decorative lighting or convenience around paths. This area light (8) can be mounted at any height. Post light (9) offers general illumination and decorative accent.* ◀

blade deep, part the grass and drop the wire. Close the opening and push the edges of the lawn together to conceal the wire.

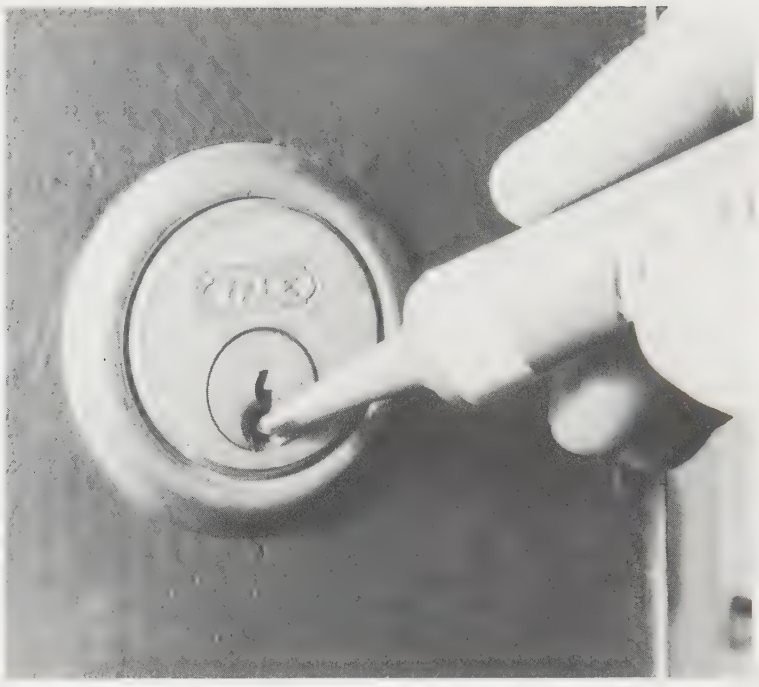
The choice of fixtures ranges from sealed beam to open-filament bulbs in spot, mushroom and flood versions. Some types concentrate light while others flood it. Try each type before you decide on a final placement. Not even a professional electrician can be certain of the effects until he sees a light in action. A change in the quantity or quality of light, or in its angle, can make a remarkable difference in the effect you achieve in your garden.

Most fixtures can be connected directly to the main line (some snap over the cable) or to stub-feeders, short extensions between the main line and fixture. Stub lines are preferred because they allow a more direct hook-up, reducing the length of the line and the voltage loss. Manufacturers of 12-volt systems recommend that 12-volt lines be no longer than 100 feet, but extra distance can be gained through an increase in gauge size when there is no alternative. The larger the wire, the less the voltage drop. Use 12 gauge wire to 100 feet, 10 gauge to 200 feet and 8 gauge wire to 300 feet. Stub lines should be of 14 or 16 gauge in every case.

Wires can be joined with solder or screw-on and crimped connectors. The latter two, used by professionals, are recommended. Be sure to cover joints with a rubber compound or waterproof friction tape to prevent corrosion. When installing light in planted areas leave a foot of loose wire beside each fixture to allow for changes as the plantings grow.

Colors can be added with filters which snap or screw in front of the fixture. Six or seven hues are generally available from blue through amber and pink. Use them sparingly. Colored lights should be accents only and too many can make a garden seem unreal.

See also: ELECTRICITY; LANDSCAPING; WIRING, ELECTRICAL.



Graphite for loosening and lubricating locks is handily packaged in plastic squeeze containers and available at most hardware stores.

Repairing Door Locks

Locks will only provide privacy and security if they are working properly. If you put your key in the door and it does not open, knowing how the lock works will save you in locksmith bills

COMMON LOCKS on your doors provide privacy and security—when they're working right. But suppose you insert the correct key into a cylinder (pin-tumbler) lock and it will not turn. After jiggling with it unsuccessfully for a while, you could call in a locksmith or get in through another door, remove the lock assembly and take it to a lock shop. Either solution can be very expensive and may leave your house unprotected while the lock is gone. A better idea is to learn about locks and fix them yourself.

Except for the combination type, all locks have two things in common—a key of special and individual size and shape and a bolt that fits into the casing. Turning the key withdraws the bolt and the door is open. But locks vary in the security they provide. A simple "warded" lock that requires the key only to pass some obstruction is common on furniture, "just to keep the honest people out." Interior door locks include wards plus a lever tumble that must be raised to a certain height by the key before the lock will release. These locks offer security against young children, but dime stores sell "skeleton" keys, one of which will almost surely open any one-lever lock.

For maximum security on exterior doors, you will use the 5-lever, bit-key locks and

longleaf yellow pine: see boat building

the pin tumbler lock operated by a wavy-type or paracentric key. The wavy effect of the key shape acts similar to a ward and offers additional key change possibilities. There are no "skeleton" key possibilities for either of these locks. Regardless of how the lock is mounted—mortised into face of door, mounted on inside or through the door, the lock must secure the door and yet be easy and quick to operate. Many people have been burned to death struggling with a reluctant lock.

What kinds of problems with these locks are you likely to run into? Most common is refusal of the lock to turn when you insert the right key. It can be due to sticky pins which may be cured by blowing powdered graphite into the keyhole. Never use oil in a cylinder lock. If the graphite treatment does not work, then the cause is probably wear on the key, a poor duplicate key or worn pins. To get at the trouble, remove the locking mechanism by loosening the two screws in the lock plate that holds the cylinder in place, then unscrew the shell with the key. Remove the screw that holds the cam to the cylinder or plug and remove the cam. Be careful not to let the cylinder slip out of the shell.

Push out the cylinder from the shell with a short length of tubing or dowel to keep driver pins and springs in place. With the key in place, check the cylinder to see if the pins are all flush with the surface. If any pins are either too long or fail to meet flush with the surface, that is the cause of the trouble. Pins that are too long can be filed flush, but short pins must be replaced. You can buy new pins from your local locksmith.

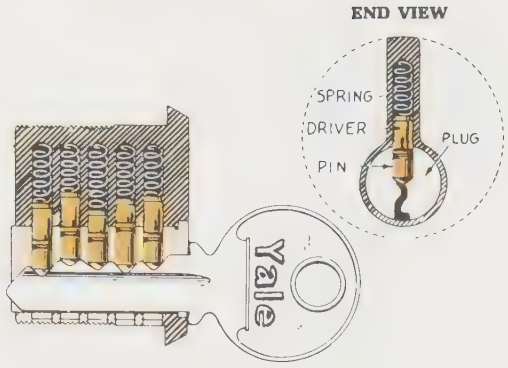
Remove short pins with tweezers. File off the new pins flush, with the right key in position. Remove any burrs left from the filing by lifting it out of the socket and filing the edges. Apply graphite to all pins before slipping shell back onto cylinder. Graphite for locks is handily packaged in plastic squeeze containers and available at most hardware stores.

Driver pins rarely cause trouble except when a spring breaks. Most lock shells are built with a cover that can be tapped off to expose springs and driver pins. If your lock does not include a cover, there is nothing to do but empty the driver pins and springs out through the cylinder hole. When replacing them, start at the back of the cylinder and work through the hole, one pin at a time. As they slip into place, work a dowel or tube from the back to keep them in place. New drivers and springs are available at locksmiths and also at many hardware stores.

When putting the locking mechanism back in the door, the cam should be in its locked vertical position and the shell screwed tightly against the spacing collar at the back. Line up the cam to engage the arm or lever in the lock case. Sometimes a collar of a different thickness or an adjustable spring collar can be obtained to locate the assembly in a different position so it will work better.

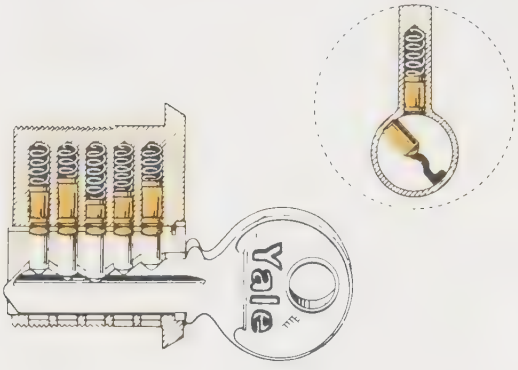
Another problem is to have a key break off in the cylinder. It may be possible to remove the broken key end with a long crochet hook or thin wire with a tiny hook on the end pushed in along the top of the keyhole (this pushes the pins up). Hook the end over the key and work it out of the lock. If this does not work, remove the locking mechanism and the cam from the back side which will allow you to push the key out with a wire.

The second type of door lock is the mortise lock. Most sluggish mortise locks are caused from gummed or sticky parts. Try blowing graphite into the lock with the latch bolt retracted. If this does not correct the trouble, remove the lock from the door by first unscrewing the set-screws holding one of the knobs to the spindle. Some knobs are threaded on the spindle; others slip on. With one knob off, pull the spindle

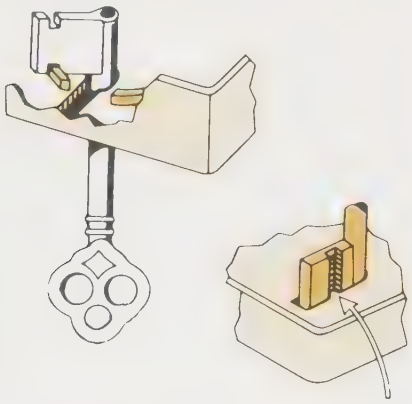


In case of a wrong key being used, pins and drivers are in irregular positions, forming obstructions which prevent rotation of the plug.

The right key will line up the pins and drivers at their intersections so that the plug may be turned to operate the lock.



This key (for a warded lock) must pass an end ward in order to rotate.



through from the opposite side and remove the screws from the face of the lock. Pry the lock out with a screwdriver.

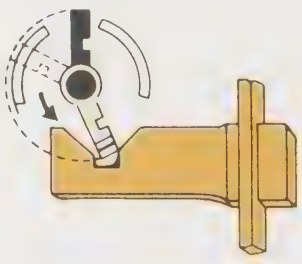
Disassemble the lock by removing the screws in the side of the case, and soak the assembly in paint thinner or mineral spirits. For particularly dirty locks, scrub and brush the individual parts to remove grime. Wipe parts dry with a cloth, reassemble and dust with graphite until lock works smoothly.

Where the tumbler fails to operate the latch, you may have a broken tumbler spring. Flat spring stock suitable for cutting a new spring is available at most hardware stores. Common pliers are all you need to cut and bend a new spring to fit. If you should cut the spring short, you can enlarge it slightly by peening it with a hammer. File down a long spring to get a tight fit.

The catch-bolt spring may be broken if the bolt fails to extend properly. Most hardware stores carry lengths of compression coil-spring stock in a variety of diameters, so one should fit your lock.

For maximum security, exterior locks should be of the dead-bolt type. Once the bolt is in the keeper and the door locked, it is impossible to force the bolt back without using the key. To keep a burglar from forcing back a beveled bolt with a knife, drive several brass screws through the stop mold in line with the lock bolt, then fill the countersunk holes with putty.

After passing the respective wards on this lock, key rotates so as to lock the bolt.



Repairing Door Locks

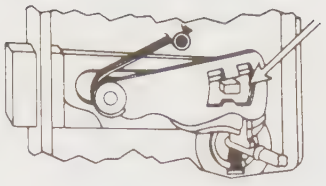
Settlement of the house structure or shrinking of partitions may move lock or strike plate enough that the bolt no longer enters the hole in the plate. If the bolt is only slightly off, you may be able to file out the opening in the strike plate. However, the best cure is to shim out the door hinge causing the door to hang improperly.

Loose door knobs are often troublesome. One cure is to loosen the set-screw and remove the knob from the spindle. Drop a pea-sized pellet of putty inside the knob and force it on the spindle. The putty forms a cushion to take up the excess space.

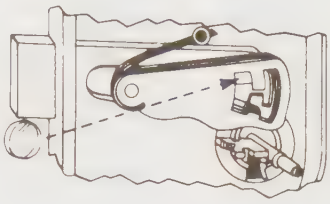
Keys can be so easily duplicated by a locksmith or your local hardware store that it hardly pays for you to file the blanks down yourself. If no master key is available from which to make duplicates, remove the lock or cylinder shell from the door and take it to a locksmith. He can make a new key in minutes. If the key cannot be duplicated or made from the lock immediately, be careful of the person you're dealing with. Members of the Locksmith Guild or locksmiths who represent a reliable safe manufacturer are checked and certified. There are cases where so-called locksmiths repair locks and keys only to gain access to your home. It is not a good idea either to carry your keys on a tag with name and address or car license number.

If your youngster locks himself in the bathroom or other room, you can try the old trick of slipping a newspaper under the door and pushing the key out so it drops on the paper. Then pull the paper and key under the door. Keep talking to the child to keep him from swallowing liquids from the medicine chest. But most interior doors lock with a turned bolt rather than keys. If there is no slot for opening the door from the outside and there's no outside window you can crawl through, rig up an auto jack with some scrap lumber. By working the jack, even the tightest door jamb will spring enough to let the bolt out of the keeper.

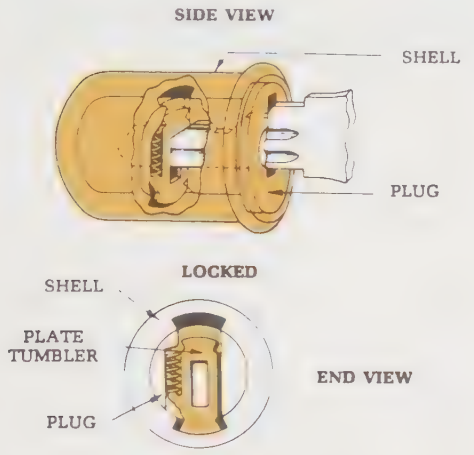
See also: ALARMS, BURGLAR; DOORS.



On this lever tumbler lock, the key has aligned the lever tumblers so that the "fence pin" is passing through the "gate," and the bolt is thus turned.

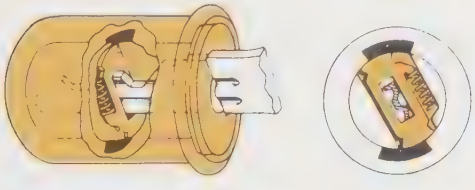


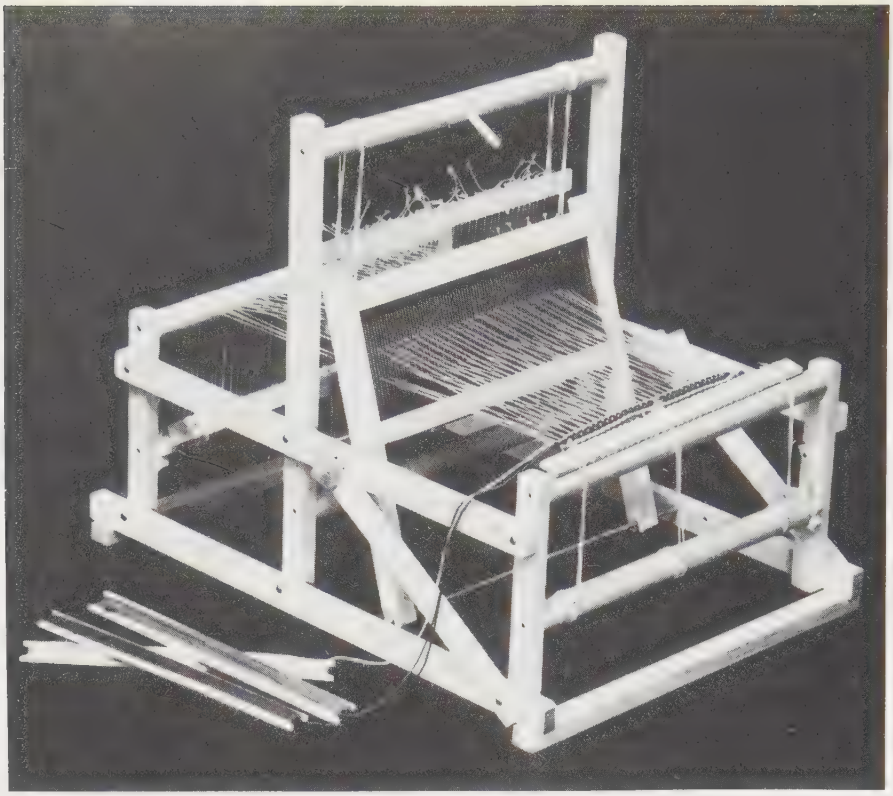
The bolt is in locked position and deadlocked against end pressure by the "fence pin," as the lever tumblers fall back into place.



On disc or tumbler locks, until the proper key is inserted, the plates extend into the shell, thus preventing the plug from turning.

Proper key aligns plates, bringing them out of the shell and within the diameter of the plug. Plug is turned to operate the bolt.





Want to build your own loom? This simple table-top model, available as a kit, with its open structure can serve as a guide in building more elaborate models.

Constructing a Table Top Loom

Weave anything from a necktie to a dress with a light professional unit you can build yourself

HAVE YOU EVER wanted a small, lightweight loom which would do a creditable job in the hands of a beginner?

You can place this two-harness model on any convenient table and weave top-quality material up to 12½ inches wide and ten yards long. Women will like it because it is easy to handle, weighs only seven pounds and requires little storage space. The width is sufficient to make many types of suits or skirts for ladies. They can hold it in the lap and weave while sitting in a comfortable chair by the television or high fidelity set.

Professional weavers use this unit as an alternate loom for color planning, sample making, teaching, and for numerous small projects. It is as easy and economical to build as it is to operate. Loom parts such as heddles, reeds, reed hooks and the like, as well as complete loom kits of various sizes can be obtained from any of several craft supply houses.

Shaping and finishing. It is a good idea to shape all the wood parts first to dimensions in the Materials List. Drill all holes, round off all edges, and sand the pieces smooth to lessen the chance of threads snagging somewhere on the loom during the weaving process. Caution: do not use softwood dowels because frame-holding screws may pull out when loom is in use.

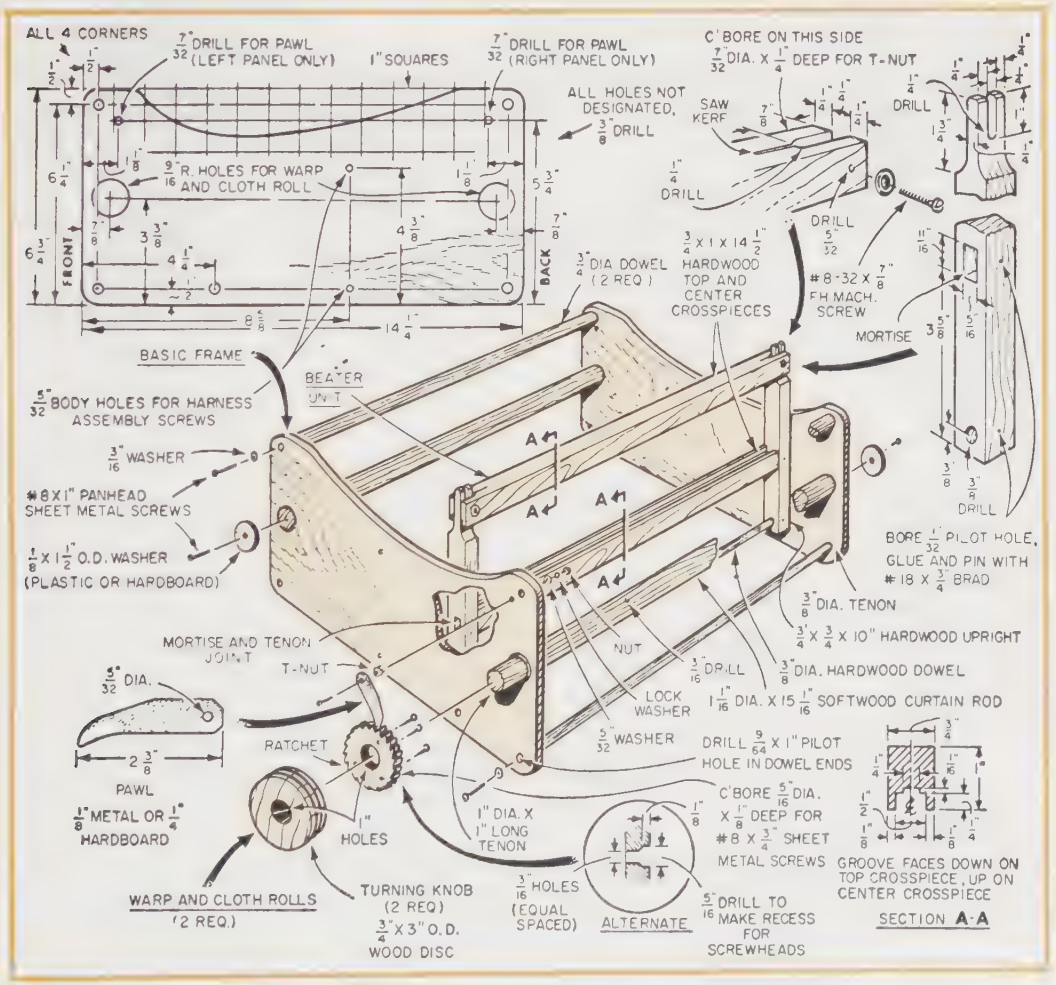
Assembling the frame. Be sure to cut tenons on dowel ends for a press fit into side panel holes, rather than butt dowels

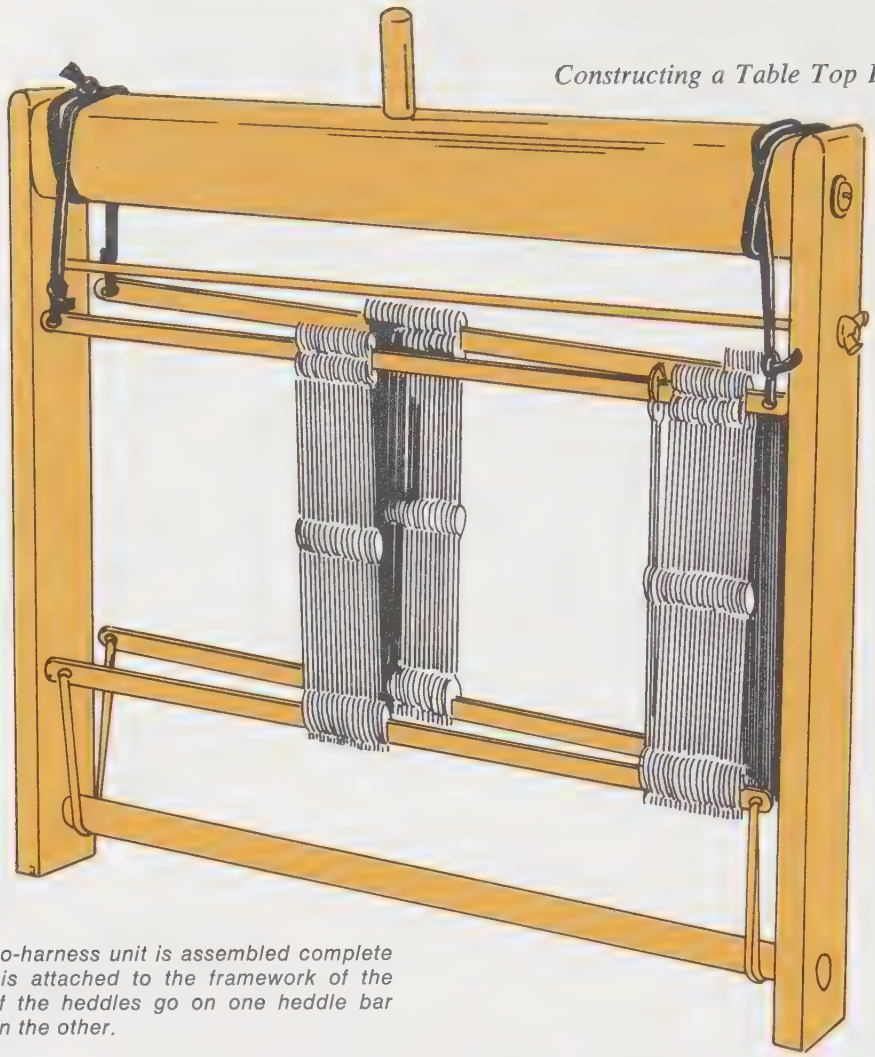
loudspeakers: see science projects
louvered panels: see room dividers
low voltage switching: see remote control switches
lubrication: see oil, engine

against the plywood. You will need the additional strength of the tenon joints to withstand warp tension during operation of the loom. If a wood lathe is not available, you can whittle the tenons with a pocket knife. You might also cut them on a circular saw by rotating dowel ends against the protractor head, using the ripping fence as a stop for depth.

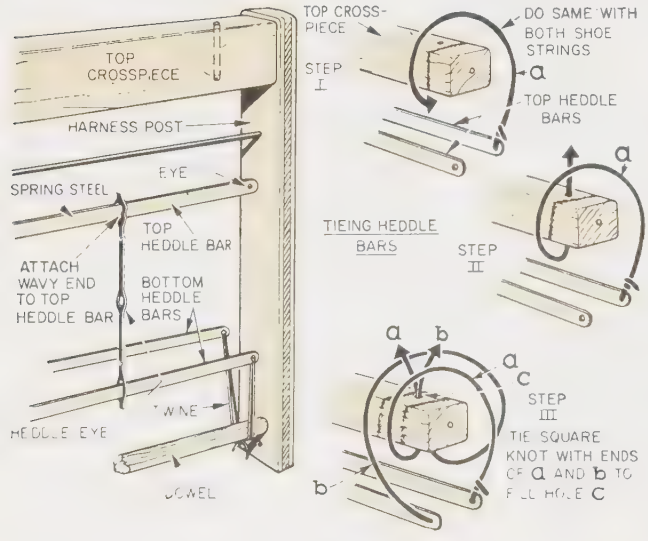
Drill 9/64-inch pilot holes 1-inch deep into dowel ends, then fasten dowel crosspieces to panels with #8 x 1-inch panhead sheet-metal screws. However, defer this assembly at one of the front ends until you put the beater in place. Sheet-metal screws are used because their heads are case-hardened and their threads hold better in end grain than wood screws of the same size.

The beater unit. This is a framework that holds the reed, actually beats the weft, or woof, thread across the warp tightly into the cloth. Glue tenons of grooved center crosspiece in mortises of the two uprights and pin in place with a ¾-inch brad. Flathead screws and T-nuts are preferred to attach the top crosspiece to the uprights. While you could use 3/16-inch diameter x 1¼-inch bolts and wing nuts, threads are more likely to catch on them when weaving.


ALL 4 CORNERS
7/32" DRILL FOR PAWL (LEFT PANEL ONLY)
1" SQUARES
7/32" DRILL FOR PAWL (RIGHT PANEL ONLY)
C'BORE ON THIS SIDE 7/32" DIA. X 1/4" DEEP FOR T-NUT
ALL HOLES NOT DESIGNATED, 3/8" DRILL
SAW KERF
DRILL
9/16" R. HOLES FOR WARP AND CLOTH ROLL
FRONT
BACK
3/4" DIA DOWEL (2 REQ.)
3/4 X 1 X 14 1/2 HARDWOOD TOP AND CENTER CROSSPIECES
#8-32 X 7/8" F.H. MACH. SCREW
MORTISE
BASIC FRAME
BEATER UNIT
5/32" BODY HOLES FOR HARNESS ASSEMBLY SCREWS
3/16" WASHER
#8 X 1" PANHEAD SHEET METAL SCREWS
1/8 X 1 1/2" O.D. WASHER (PLASTIC OR HARDBOARD)
BORE 1/32" PILOT HOLE, GLUE AND PIN WITH #18 X 3/4" BRAD
3/8" DIA. TENON
3/4" X 3/4" X 10" HARDWOOD UPRIGHT
MORTISE AND TENON JOINT
T-NUT
NUT
3/16" DRILL
3/8" DIA. HARDWOOD DOWEL
LOCK WASHER
1 1/16" DIA. X 15 1/16" SOFTWOOD CURTAIN ROD
5/32" DIA.
RATCHET
5/32" WASHER
DRILL 9/64 X 1" PILOT HOLE IN DOWEL ENDS
2 3/8"
PAWL
1/8" METAL OR 1/4" HARDBOARD
1" HOLES
1" DIA. X 1" LONG TENON
C'BORE 5/16" DIA. X 1/8" DEEP FOR #8 X 3/4" SHEET METAL SCREWS
GROOVE FACES DOWN ON TOP CROSSPIECE, UP ON CENTER CROSSPIECE
SECTION A-A
WARP AND CLOTH ROLLS (2 REQ.)
TURNING KNOB (2 REQ) 3/4" X 3" O.D. WOOD DISC
3/16" HOLES (EQUAL SPACED)
ALTERNATE
5/16" DRILL TO MAKE RECESS FOR SCREWHEADS



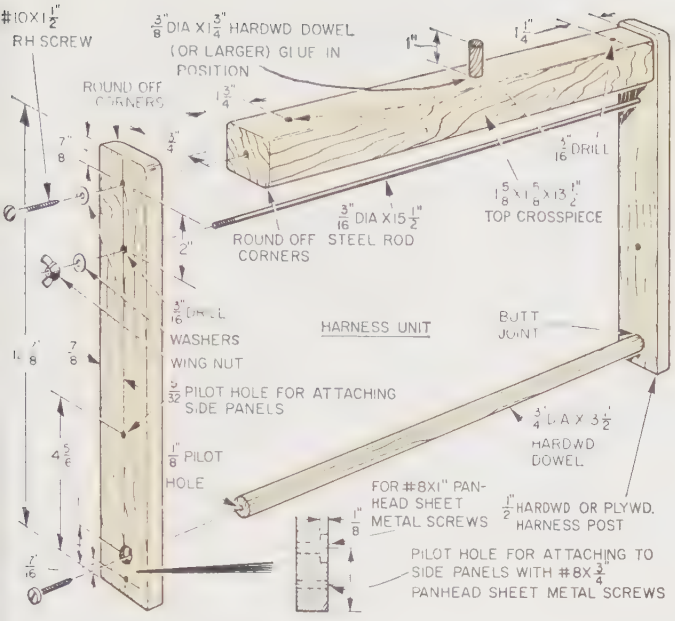
▲ *The two-harness unit is assembled complete before it is attached to the framework of the loom. Half the heddles go on one heddle bar and half on the other.*

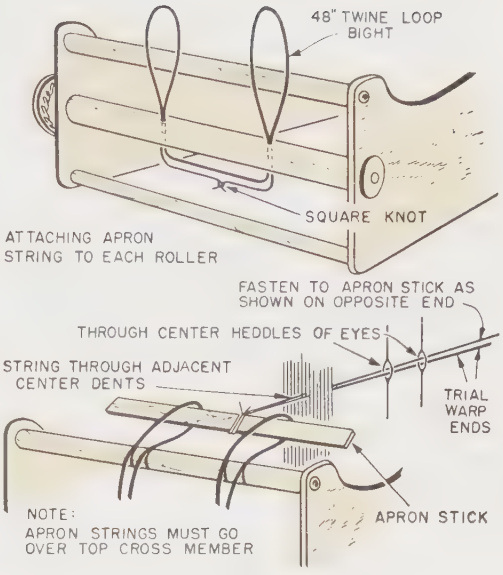


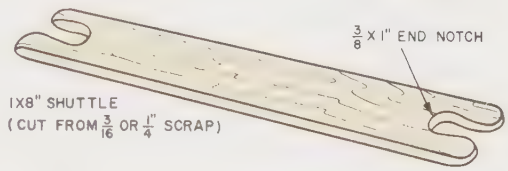
Insert a ⅜-inch diameter x 15-inch dowel through bottom holes of uprights to allow a ⅜-inch projection on each side. Drill 1/32-inch pilot holes clear through uprights and dowel, so brad may be backed out if necessary at a future time. Pin in place by inserting brad.

Loosen adjustable top piece to insert the reed in the crosspiece grooves and fasten in place. Now you can install the completed beater assembly in the frame holes and lock it in position by completing assembly of the basic framework.

Warp and cloth rolls. These are identical, each made from 1 1/16-inch diameter curtain rod. Place in your lathe and turn a 1-inch diameter by 1-inch long tenon on one end




48" TWINE LOOP BIGHT
SQUARE KNOT
ATTACHING APRON STRING TO EACH ROLLER
FASTEN TO APRON STICK AS SHOWN ON OPPOSITE END
THROUGH CENTER HEDDLES OF EYES
STRING THROUGH ADJACENT CENTER DENTS
TRIAL WARP ENDS
APRON STICK
NOTE:
APRON STRINGS MUST GO OVER TOP CROSS MEMBER



of each for a press fit into center holes of the wood discs cut as turning knobs. Glue pieces together and reinforce each assembly by pinning with a 10d nail. Cut head off nail and tap all of remaining length into pilot hole drilled across knob and through the rod.

Each roller needs a pawl and ratchet. Though you get these in the metal kit, you can make them from ¼-inch tempered hardboard. Fasten each ratchet to a knob with three #8 x ¾-inch sheet-metal screws. Make the two pawl assemblies and attach to basic frame. To make sure the pawl will work freely, fasten the machine screw tightly into the T-nut, back off one-half turn, then lock in place with hex nut at end.

Now insert warp and cloth rolls in their side panel holes, holding pawls over them until ratchets are in place. To hold rollers in position, cut two 1½-inch diameter discs out of ⅛-inch hardboard, plastic, metal or other rigid material. Drill disc centers with shank holes for a #8 x 1-inch panhead sheet-metal screw and install on roller ends. Note that discs should not rub tightly against the side panels or they will interfere with roller action.

Harness assembly. Glue the dowel handle in the center of the 1⅝ x 1⅝-inch top crosspiece, then attach this member, with handle up, to the top of the hardwood uprights. Center drill ⅛-inch pilot holes in ends of the ¾-inch dowel cut for the lower crosspiece and butt against uprights in position for fastening with screws whose heads are recessed in the uprights.

Slip the 3/16-inch steel rod through holes in uprights, and fasten with wing nuts on each threaded end. This rod acts as an adjustment providing added friction when the weaver wants the warp shed to remain open while doing lace weaves.

Now you are ready to install the heddles

MATERIALS LIST

Quantity	Size and Description	Purpose
1	1/4" 15"x15" plywood	side panels and shuttle
2	1/2" 1 5/8"x12 7/8" plywood or hardwood	harness posts
1	1 5/8" 1 5/8"x13 1/2" fir or hardwood	harness top crosspiece
2	3/4" 3/4"x10" hardwood	beater assembly uprights
2	3/4" 1"x14 1/2" hardwood	beater top and middle crosspiece
2	3/16" 3/4"x13 3/8" pine or fir	apron sticks
2	1 1/16" dia. x 15 1/16" softwood curtain rod	warp and cloth rolls
2	3/4"x1" I.D. x 3" O.D. wood discs	turning knobs
2	1/8"x1 1/2" dia. hardwood or plastic discs	roller holders

NOTE: Also need shoe strings, twine, glue and hardware.

which, like the reed, are something you buy and do not attempt to make. Align heddles together, then slip the wavy ends of half of them over each top heddle bar. Use two 40-inch shoestrings to hold them in place on the harness frame. Cut a string in half, then tie cut ends to eyes at one end of the heddle bars. Run each string around and through top crosspiece. Repeat process at other end of the bars, then adjust strings until the bars are level and secure temporarily with bow knots. Tie bottom heddle bars temporarily with sack twine.

You can now place the harness in the framework. Secure it using #8 x 3/4-inch panhead sheet-metal screws. If you have not prefinished the wood, this is the time to treat it to keep slivers at a minimum. Sand parts smooth and apply a clear penetrating lacquer. Build up with a spray-on gloss lacquer or brush-on varnish. Paint is not recommended here.

Heddle alignment. The apron sticks are attached next. Cut two 48-inch lengths of sack twine and form a loop with each string by tying ends together. Shape a small hook on a short length of wire to pull a string through the holes of each roller. You can straighten out a paper clip and rebend it for this job. Now insert a 3/16 x 3/4 x 13 3/8-inch apron stick through the two bights of each string.

Cut two more lengths of twine, about 30 inches, and tie one end of each to the center of an apron stick. Pass them through the reed and eyes of center heddles. Tie other ends to center of other apron stick and turn roller knobs until strings are taut. With crosspiece handle in vertical position, adjust shoestrings until the twine passes through the middle of the heddle eyes. Re-tie the shoestrings, using square knots, followed by bow knots to take up any extra length. Re-tie the bottom heddle bars just enough to take out any slack.

Now that your table top loom is completed, make up a shuttle to hold the weft thread which crosses the warp (lengthwise) thread in a woven fabric. You can use any piece of scrap material about 3/16 x 8-inch. Shape and smooth as illustrated.

See also: CRAFT PROJECTS; HANDICRAFTS.

WHERE TO FIND IT

One source of loom parts is School Products Co., Inc., 312 East 23rd St., New York, N.Y. 10003.

Checks and splits are easily spotted in stacked lumber such as these 2x4s and 2x3s. However, it is not important for most structural uses, unless flaws are extensive.

Buying the Right Lumber Grade for Your Needs

Understanding the grading of lumber will help you purchase the lowest grade suitable for your job; this will save you the expense of getting lumber too good for its purpose

ALWAYS BUY LUMBER to suit the job and, for economy's sake, do not buy a higher grade than you need. The grades described are those of lumber types you are most likely to use, and are based on the WWPA (Western Wood Products Association) Grading Rules. (Grades you are not likely to use are not included, as a description of all grades would be too lengthy.)

The grading is done rapidly by eye at the mill, so each batch of a given grade may contain a few pieces of the next higher grade and the next lower one. If you are buying in quantity you'll usually come out even on the unders and overs. If you're buying a single piece, you can usually examine it at the point of purchase.

For appearance applications, as in cabinetwork and trim, buy a select or finish grade. In the species commonly used for this purpose (white pine, etc.) there are three grades of "selects," the highest quality level generally available. The top grade may be called 1 & 2 Clear, B & Better, or Supreme—in the case of Idaho White Pine (IWP). The next lower grade is "C" Select or Choice (IWP). The third grade is "D" Select or Quality (IWP).

The difference between grades is based on the cause and number of natural flaws, or the area they cover, computed from a piece of lumber 1-inch thick, 8 inches wide, and 12 feet long, smooth-surfaced on both sides and edges. As examples, 1 & 2 Clear permits two sound, tight pin knots (very small knots) while "D" Select permits four

If you plan to use structural lumber for appearance purposes, as in making lawn furniture, or for a beamed ceiling, select each piece. Look for warp, twist, curve, and end checks and splits. If the available batch has end splits but is otherwise good, you can buy slightly overlength lumber and cut off split ends.

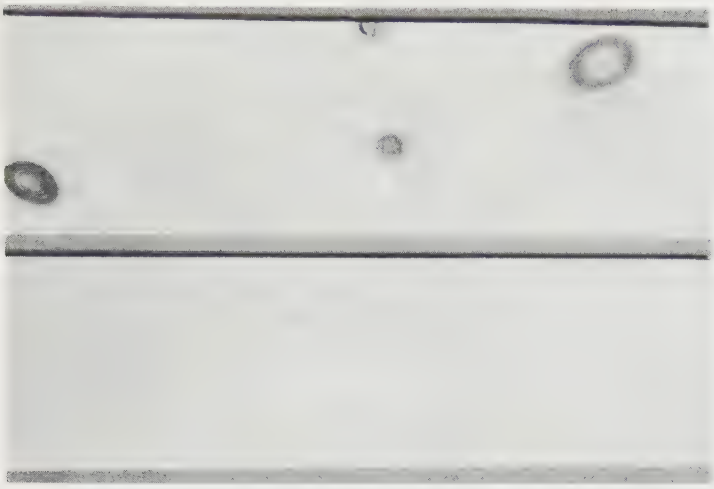
small fixed knots, or the equivalent in smaller ones. A proportionate difference in flaws like stain, pitch streaks, and others also figure in the grading.

In general, pick the top grade (1 & 2 Clear) for work that will have a natural finish, a lower grade for a paint finish. And, if possible, hand pick the lumber, if you are buying only a few pieces. In many cases, if the project calls for cutting the lumber into shorter pieces, it can be cut in such a way as to exclude the flaws, utilizing the clear lumber between them. So a lower grade of lumber actually gives you the equivalent of top grade.

Three "finish grades," Superior, Prime, and "E," complete the classification of Selects and Finish grades. In buying, pick your lumber from the lowest of these grades which will provide the appearance

Laths, used in plastering, are rough sawn, sold in 4-foot-long bundles containing 100 pieces, for total footage of 400 feet. Also sold in half bundles. It is very inexpensive compared with other lumber. It is good for many outdoor purposes, such as in trellis and fence work. (It's cheaper than trellis strip, but not as economical to paint, requiring many coats.)

Wood shingles are sold in bundles and half bundles. You figure coverage by the "square," which is enough to cover 100 square feet. See text for "exposure," or amount of overlap, and effect on extra coverage possible with bundle.

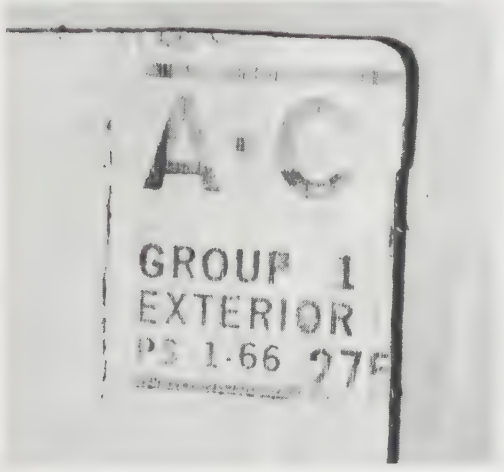


Lumber grade differences. Lower piece of white pine is grade known as 1 & 2 Clear or B & Better. (With Idaho white pine, it is called Supreme.) It has practically no surface flaws. Upper piece is No. 2 Board Grade (No. 2 Common), considerably lower in cost but with knots. Strength is affected little by knots in this grade. Comparable grade in Idaho white pine is called Sterling.

Sterling grade stamp on Idaho white pine is shown.

required. Before painting, knots should be sealed with fresh shellac.

The board grades, often referred to as "Commons," consist of five quality levels. These grades (more economically priced than Selects and Finish grades) include those suited to use for utility jobs like closet shelves and workshop storage cabinets. No. 1 Common (Colonial IWP) is often used where a quality-finished knotty effect is desired. The knots are



Plywood stamp shown tells you that one surface is "A" grade, the other "C", and that wood species used are from Group 1. Also, it is exterior grade—very important for outdoor use, or where exposed to moisture.

Type of surface flaws that make "C" grade surface: knotholes in surface plywood, splits, or checks. These have little effect on strength, but make surface unsuitable for appearance finishing.

Full and "nominal" lumber sizes. Top to bottom: 2 x 2 (full size shown by black outline) is actually 1½ x 1½; 2 x 4 is 1½ x 3½; 2 x 6 is 1½ x 5½; 2 x 8 is 1½ x 7¼—actually ¾-inch narrower than nominal size. All widths larger than 8-inch (nominal) are also ¾-inch narrower than their nominal designation.

larger than in the Select grades, but are firm. No. 2 Common (Sterling IWP) may also be used in a similar manner, but medium stain over the entire surface sometimes rules out a natural finish. It is a cost saver in building applications, as for painted fascia boards, cornices, and similar surfaces. The knotty board shown in the photo is of this grade. This piece had no stain, as is often the case. Other factors placed it in the No. 2 grade. No. 3 Common (Standard IWP) may have deeper stain over the entire surface, and other features that limit its appearance uses to a greater extent, but do not interfere with its utility uses, as in shelving and fencing. As with other grades, the fact that certain flaws are permissable does not mean that every piece will contain them. Many pieces of No. 3 will be found suitable for appearance uses. No. 4 Common (Utility IWP) is graded chiefly for serviceability, since it is seldom used in exposed work except for such purposes as crating. It is also used for concealed applications in building construction.

Not all of the Board Grades are stocked by lumberyards, as demand for the lowest grades is often small. The higher Board Grades, however, are a good choice for general home workshop projects.

Hardwoods, such as hardwood flooring, are graded under separate rules. The N.O.F.M.A. (National Oak Flooring Manufacturers' Association) grades are: Clear (the top grade) and Select, in quarter sawed form. The same designations are also available in plain sawed form. Lower grades are No. 1 Common, No. 2 Common, and 1¼-foot Shorts, which consist of short pieces of flooring in special bundles. The last named grade is usually separated into two sub-grades designated as No. 1 Common and Better, and No. 2 Common.

Length of the pieces as well as the appearance is a factor in the grading. Clear averages 4¼ feet in length; Select, 3¾ feet; No. 1 Common, three feet; No. 2 Common, 2½ feet; and the 1¼-foot Shorts, 15 inches.

Lumber sizes are usually given in terms of "nominal" sizes, which are considerably smaller than full size. The reason is that the original full size is reduced by shrinkage during seasoning, and by the removal of surface material in the smoothing process.

The thicknesses you are most likely to buy for household projects are nominal 1-inch, which is actually ¾-inch, and nominal 2-inch (as in a 2 x 4), which is actually 1½ inches.

Nominal widths are ½-inch less than

full size up to 7-inch width (which is actually 6½ inches). Nominal widths of 8 inches and more are ¾-inch less than full size. Thus, a 2 x 8 is actually 1½-inch x 7¼-inch, and a 2 x 10 is actually 1½-inch x 9¼-inch. Your local lumberyard may stock only the even numbered widths (2 x 4, 2 x 6, 1 x 4, etc.) except for 1 x 3s and 2 x 3s. The most commonly used widths run from nominal 2 inches (like 1 x 2 and 2 x 2) to nominal 14 inches, such as a 2 x 14. Greater thicknesses, as in 4 x 4 lumber, are also available. Check your local lumberyard on such sizes.

The board foot, the unit of lumber measurement, represents a piece of lumber 1 inch thick and 1 foot square. It may be added or divided in any way to figure the amount of lumber in a given size piece. As an example, a piece of 1 x 12 with a length of 6 feet would contain 6 board feet. A piece of 1 x 6 with a length of 12 feet would also contain 6 board feet. And a piece of 2 x 6 with a length of 12 feet would contain 12 board feet because of its doubled thickness. The thicknesses and widths mentioned are nominal, not full. The length, however, is always full length.

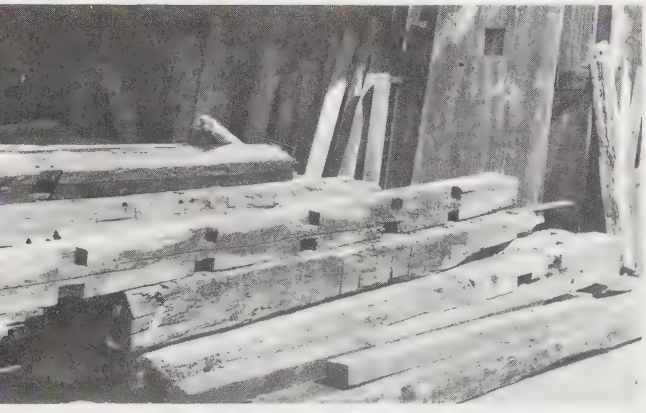
The board foot is used in figuring lumber amounts for pricing. Most yards, however, have pre-figured the prices of stock sized lumber by the running (linear) foot for convenience, as 18 cents per running foot, for 2 x 4s. Specific lengths of the various sizes may also be priced by the piece, as $1.80 apiece for 10-foot 2 x 4s, etc.

Dimension lumber is the term applied to the usual house framing sizes. In general,

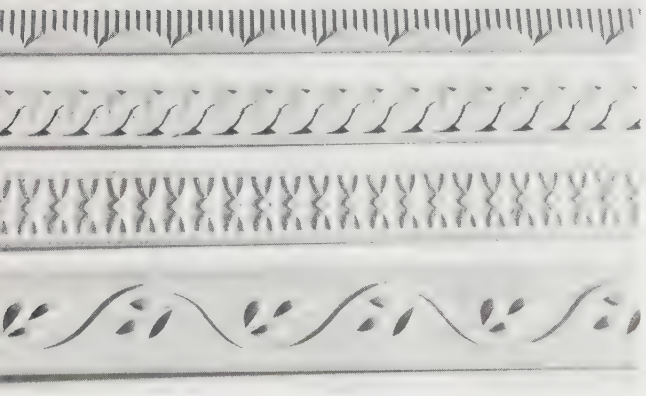
➢ *Typical lumber edges. Top is square edge; center, ship lap; bottom is tongue and groove (T & G). Exact form of these edges varies somewhat with use, as in flooring, siding, sheathing, etc.*

➢ *Typical ready-made moldings for interior trim, furniture use, etc. They're bought by the linear (running) foot. Many other forms are available; also pressed and embossed forms. Buy to suit the job.*

Used lumber is available from building wreckers' storage yards, commonly costs about half the price of same type of lumber new. You have to pull (or drive in) nails after you buy, but studs and joists are already cut and squared. They are also well seasoned. Very old framing lumber will be full size, but rough sawn.



Barn beams are stocked by some yards. These are priced about $2 a running foot; are salvage from razed barns.



For decorative effects on home woodworking projects, check local lumberyards for pressed and machine-carved moldings. Designs vary with manufacturer. Can be glued or bradded to the work; suited to edge trimming, etc.

it covers thickness from 2 inches to less than 5 inches, and all the usual widths. Although framing lumber is classified by a number of grades, local yards are likely to stock only the grade or grades required by the local building code. If you want a piece that is practically free of flaws (as a 2 x 4 for a boat mast), your best bet is a yard that will permit you to check through a number of pieces in the lumber stacks. (Don't expect to do this when the yard is busy, and always return the unwanted pieces to the stack from which you have removed them.)

Special lumber forms, such as moldings, laths, shingles, curtain cornice, etc., are also stocked by lumberyards. Moldings are usually sold by the running foot, as is the cornice material. Some yards will cut shorter lengths from the existing ones if the leftover pieces will be long enough to be saleable. Check this with your local yard if you need a short piece.

Shingles and laths are sold in bundles and half bundles. A bundle of laths contains 100 pieces. The commonest lath length is 4 feet, so a full bundle contains 400 feet. Very low in price, laths are intended for use as a wood base for plaster. They are also widely used for inexpensive lattice and trellis work. (Lattice strip is made for the purpose, and is smooth on all surfaces, but considerably high in price.) Shingles are sold in bundles containing enough to cover 100 square feet of roofing (called a square) at the usual overlap.

Plywood is available in many grades, most often in 4 x 8-foot panel size. At

most yards 4 x 10-foot is also available in some thicknesses, as well as "handy panels" of 2 x 4-foot and other small sizes.

Plywood is manufactured from about 50 different species of wood, and the types used have been classified into five groups numbered from 1 to 5. In general, plywood of Groups 1 and 2 are recommended for heavily loaded applications, the higher numbers for average use.

The face veneers (surfaces) are graded by letters, N, A, B, C, and D. N is a special order natural finish veneer of all heartwood or all sapwood, and free of open defects. You don't see this one often, but might order it for top quality cabinetwork that will be given a natural finish.

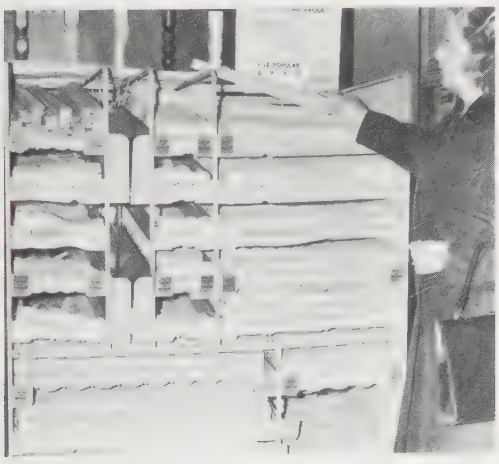
The letters from A to C represent the more widely used veneer grades, diminishing in quality from A to D. A very widely used combination is "A-C" which has a high quality (A) veneer on one surface, a much lower quality (C) veneer on the other. The "good" side is suitable for a quality paint finish. The other side may have defects such as knotholes through the veneer to the one beneath it. These defects do not affect the strength of the panel, but make that side unsuited to exposed use. Typically, the C side is used on the inside of cabinetwork, the A side on the outside.

Exterior plywood is made with completely waterproof glue and is suited to uses where it will be exposed to the weather. (It should be painted.) In Group 1 it is also suitable for boat-building. For top quality boat work, there is also a marine grade, stronger to some extent, but much higher in price.

Interior plywood is made with highly water resistant glue, but not necessarily waterproof. Slightly lower in cost than exterior, it is limited to indoor use. Do not use it for outdoor applications.

Interior plywood with exterior glue is a combination found in material used in construction work. For purposes like sheathing and subflooring, the species of woods used may be of the lower group numbers, reducing costs, and the surfaces may not necessarily be sanded. The waterproof glue, however, provides the necessary resistance to rain-wetting likely to be encountered by the plywood before the house is closed in.

See also: BOAT BUILDING; WOODWORKING.



▲ *Curtain cornice and valance stock, with decorative curve-cut edges, is available in various widths and designs. Sold by lengths from 8 to 12 feet, depending on source. Good for adding professional touch to simple work.*

◀ *Lathe-turned and machine carved pieces can be used as table and other furniture legs, spacers, etc. They can be bought at lumberyards and other outlets.*

Make Your Own "Antiques" from Scrap Lumber

Add a touch of elegance to any room in your home by obtaining some scrap wood and trying this antiquing process

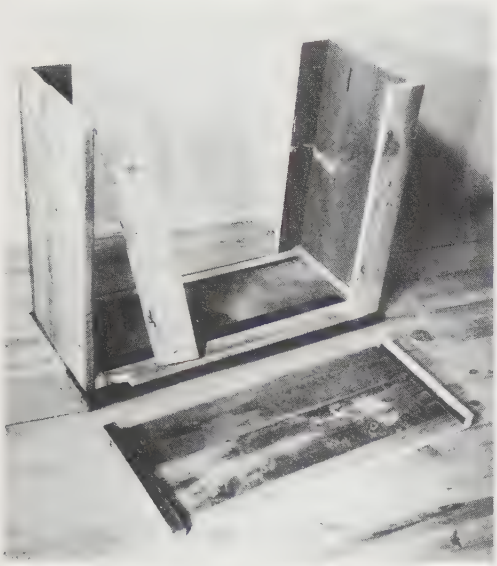
This replica of the traditional Gloucester chest cost a dollar. All wood is about a century old (from a country house wrecker), so the genuine patina of age gives a true antique effect without the use of stain.

VERY OLD LUMBER, available from house wreckers, offers an interesting and economical means of creating your own "antiques" with a mellow finish and authentic appearance. You usually have a choice of smooth or weathered surface, so you need only plan your project according to the type of piece you prefer. Early American styling makes the easiest job of it, as do other uncomplicated forms.

The cabinet shown was assembled wtih the simplicity of a crate which is a keynote of the familiar old New England fishermen's gear and bait chest, often called "Gloucester chests." The louvered doors are also an item available from house wreckers in the form of old shutters. The best way to begin is to base your cabinet proportions on the shutters, and buy your aged lumber accordingly. A weathered effect is welcome in lumber used for this particular cabinet.

Sanding. Use about 120-grit aluminum oxide paper to hand sand the surface of the wood. Do not use a block on weather-etched lumber like this as you will sand through the high spots, exposing lighter wood beneath. This destroys the aged appearance. Use 80-grit paper to slightly round all corners. Sharply cut corners do not have an antiquated look, as this type of piece usually received plenty of wear. Do the corner rounding, by drawing the sandpaper sheet over the corner in shoeshine fashion. This produces a soft, natural rounding.

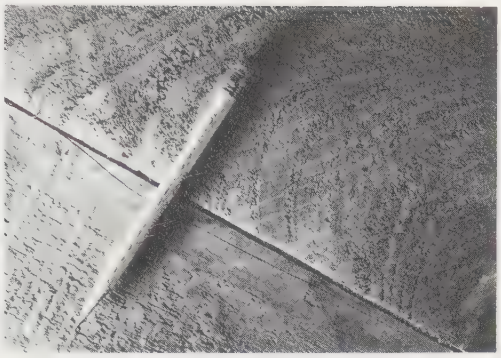
Do not aim to bring a weathered surface to full smoothness or you will destroy the



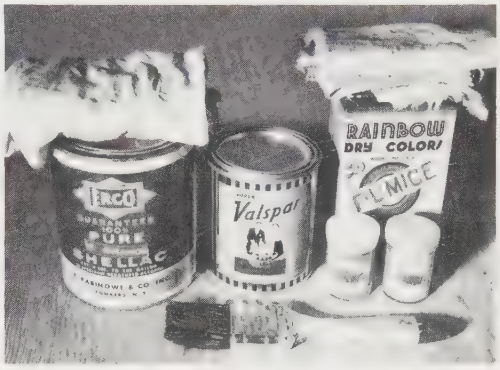
Dimensions of cabinet were based on size of the shutters, also from house wrecker. The cabinet assembly is simple—similar to a crate.

Round corners and edges with sandpaper to simulate natural wear from long use. Freshly sawed end grain should be darkened with dye or stain .

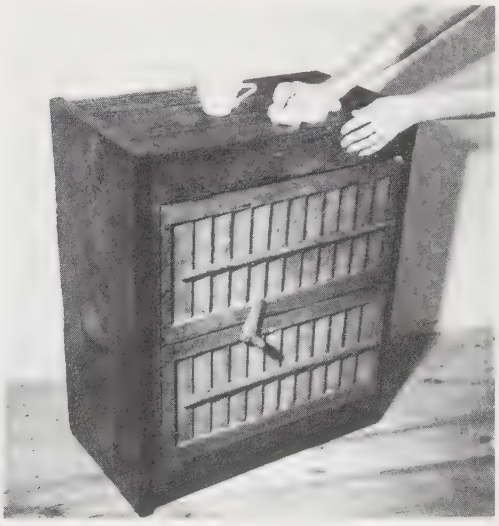
Tip the cabinet so side being finished is up, for best view of work and to eliminate chance of sags. Shellac is applied with lint-free cloth.



This closeup of the wood surface shows the point at which the sanding was stopped. After finishing, pitted areas assume a soft, leather-like texture.



Materials used in finishing. Dyes evened the tone of aged wood; spar varnish was brushed on top; orange shellac on remainder.



effect. Sand only enough to remove sharp protruding fibers. Then apply a wash coat of three pound cut shellac thinned one part shellac to five of denatured alcohol. When this is dry sand very lightly once more with fine paper to smooth away any small fibers. These, if present, are stiffened by the wash coat and are easily sanded off.

For the wash coat it is best to use clear shellac, as you can do any toning afterward. The wash coat does not interfere with staining, but actually assures an even tone.

Finishing. If stain is used before the finish coats of shellac, follow the instructions on the stain can in regard to drying time. On weathered wood the stain should be brushed on, then wiped off when the desired depth of tone is reached.

The easiest way to apply the shellac is by wiping it on with a lint-free cloth pad. The best guide to the number of shellac coats required is your own preference in the matter of luster. Two to three wiped-on coats of two pound cut shellac usually produce an appropriate finish. It can be rubbed down to dull it slightly, if too glossy. Either rottenstone or pumice may be used in an oil paste (No. 10 engine oil is about right).

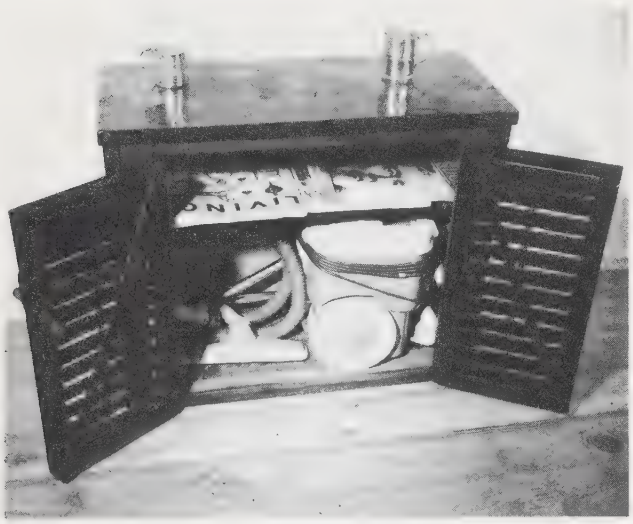
If the tone of the finish is lighter than you want, you can deepen it by using an additional coat of orange shellac or tinted shellac. The tinting (to most usual wood stain tones) is done by mixing the shellac dye with a little alcohol, then stirring the mix into the shellac. Try it on scrap wood so you can add more dye if you want deeper tone. Your dealer stocks the shellac dyes or can order them.

Waterproof finish. If beverage glasses are likely to be placed on the top of the cabinet, apply only the wash coat of shellac to facilitate final light fine sanding and permit even staining. Then use a waterproof finish. In the cabinet shown spar varnish was used for the top. Three coats, with light sanding between, produced a mellow finish with ample luster for easy cleaning. This finish withstands even boiling water. An important point in shellac work is to be certain the shellac is fresh. To be safe, buy an established brand and use it promptly.

As weathered wood may have tones far different from new material it is not always wise to stain it. If an attractive and unusual tone is present it may produce the most effective result if simply shellacked or varnished. If the tone is right but uneven in some areas it may be possible to blend it with aniline dye.

The shutters that form the doors were covered with green paint when purchased. Paint remover was used to expose the wood. Apply it liberally in order to reach all surfaces of the frame and louvers. It is not necessary, however, to remove the paint from the back of the shutters, as that surface may be painted. This allows you more time for a thorough job on the front without making the job tedious.

See also: ANTIQUING; EARLY AMERICAN; FINISHING, WOOD; FURNITURE, USED; STAINING.



Completed chest provides always-handy storage space. Here it houses magazines on shelf, vacuum cleaner below. Shape makes it easy to roll vacuum in.

Making Furniture from Crates

You can convert old shipping crates and wooden boxes into antique-looking furniture

UNTIL YOU TRY it for yourself, it is hard to believe you can build beautiful furniture from cast-off wooden cartons and crates. Actually, however, many of these cast-offs are made from unusual and beautifully grained woods unobtainable at the average lumberyard. One reason for this is that some of the most attractive grain effects in many woods occur only in short sections between large knots that would render the wood unfit for ordinary structural use. But these short lengths are ample for most crate and carton usage, and are economical materials for crate makers.

In the raw material photo, the containers shown are a Scotch whiskey case, an imported cheese carton beneath it, and at the bottom a crate that brought a load of halibut to a supermarket. The open-slat crate at the left of the picture contained a power tool, and provided assorted cleats and other parts when working with the others.

Both the cheese and the fish boxes were left outdoors for several weeks to permit rain and fresh air to eliminate the aroma. Then the furniture building began.

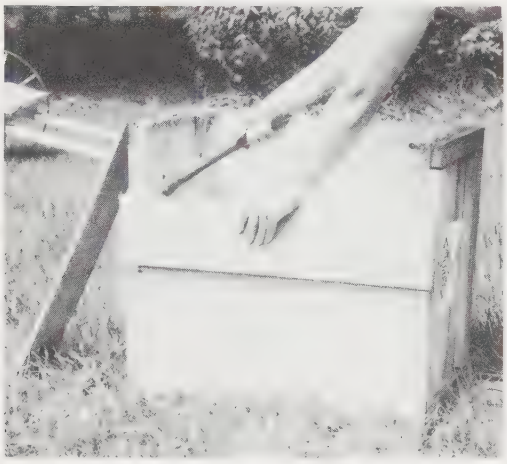
The first step in turning crates into furniture consists of measuring the crate "as is." In many cases, the size will be such that a cabinet or chest can be made from it without taking it apart. In other instances it may be possible to simply cut it shorter and replace an end, or perhaps remove a strip

of board to make it narrower. If such alterations will not bring the crate to furniture proportions, take it apart altogether and use the wood to build what you want. The record cabinet and blanket chest illustrated were both made with little change in the proportions of the original crates. The small storage cabinet-end table required only the sanding off of the liquor label and the addition of a top and feet.

If you have a power sander or a sander attachment for your power drill, it is a simple matter to remove the labels from crates and cartons, even though many of them are indented in the wood. Start with a coarse abrasive, if the label is indented. In some instances, you can take the crate apart and reassemble it inside out so the label is inside, leaving the outside of the unit clear.

If the lid is missing, simply look a bit longer and you will find other crate material to make one. Also keep in mind that since the bulk of your material is free, you can afford to add a lavish touch to a detail or two. This might be the top of a cabinet, as in the case of the record cabinet made from the cheese crate. The "lavish" touch added was a marble top made from a stray piece of marble bought from a house wrecker for 80 cents. The wood rim around the marble is made from slats taken from an air-conditioner crate. In this case, the crate was wood-framed with corrugated fiberboard walls. So do not pass up a crate because some of it is fiberboard or cardboard.

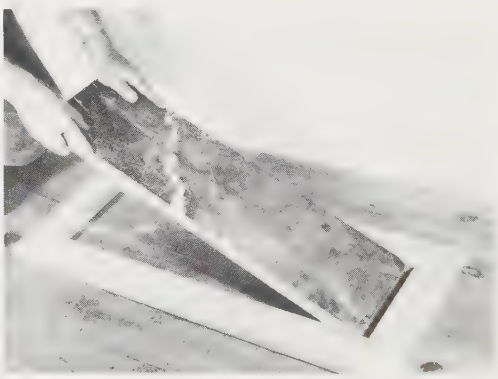
Save the nails when you take a crate apart or alter its proportions. They are the proper size for the thickness of the wood used, so they reduce the chance of splitting when you reassemble. They are usually box nails with slender shanks and medium-sized flat heads. But they can be sunk below the surface and puttied over almost as



Tap crate sides out, then tap back in to raise nail heads. Pull out the nails.

Rim around marble top is simply butt-joined at corners. Nails are set deep.

Marble fits inside wood rim, can be removed for cleaning or wood refinishing.



easily as finishing nails. For the putty, use a tone similar to the finish you plan for the entire piece. If the proper tone is not available, you can tone the filler yourself during the finishing.

Assorted woods are sometimes used in a single crate, particularly those used in ship imports. This shows up after sanding, and should not be considered a disadvantage. The sides of the cheese crate, for example, were handsomely wavy-grained in true olive wood pattern. The ends were lighter-toned and clear. The overall effect is better than if the entire piece were of the same wood.

To begin the record chest, one side of the cheese crate was removed so that the horizontal strips of which it was made could be used vertically in the doors. Slats from the small power tool crate provided the cleats that hold the doors together. Similar slats provided the base rim nailed under the crate to provide door clearance above the floor. More crate material made the shelf. Hinges were of the dime-store butt variety. A pair of cup hooks and wooden curtain rings were linked to form the door handles.

The finish was given a warm tone by wiping all wood with a light solution of cocoa beige detergent type aniline. The detergent in the dye helps it penetrate the pores of the wool as well as fabric. And dye has another advantage: if you tone too deeply you can use a color remover to remove the color quickly. Then you can start again with the lighter tone you want. To make a dye tone lighter all you do is dilute it with a little more water. To deepen it use less water or apply it to the wood several times.

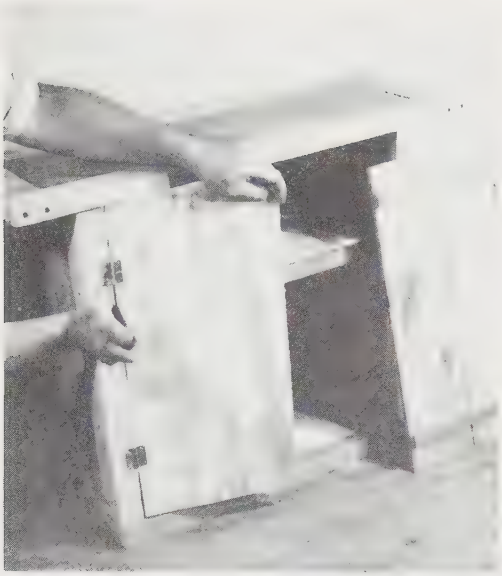
After it dries thoroughly, go on with your finishing. In the case of the record chest, a light coat of well-thinned shellac went on after the dye. This stiffens the minute wood fibers on the surface so they can be scuffed off with fine sandpaper. The result: a super-smooth surface. The succeeding coats were of a quick-drying ring-proof finish that's almost water clear.

The blanket chest was made from the fish crate by shortening it three-inches to allow for door clearance in the room where it was to be used. In another spot no changes would have been necessary. As the lid boards were still in the crate when it was rescued from the trash pile, the only additional material required was for cleats and feet, which were obtained from other crates. The only hardware needed—a pair of hinges. Here, however, you can add a period touch with some wrought iron strap hinges. The difference in price is usually less than a dollar. If you use the lower priced hinges you can get almost the same effect by using T hinges and painting them with flat black paint.

This chest was partitioned into several sections to separate the different items stored in it. The partitions also serve to provide added central support for the lid when the chest is used as a seat.

The Scotch case was found complete with lid (usually the case) and required only a pair of hinges and a friction catch to complete the basic job. The lavish touch was again provided by the top—a small 30 cent marble scrap from the wrecker. If you do not live near a wrecker or other source of low-priced marble scraps, there are several other ways to dress up the tops of your crate furniture. You can use a dime store mirror. You can also use ordinary double thick window glass with a coat of enamel on the under side. A deep red or black produces an expensive appearance at a glass cost usually around 25 cents in the small size needed for this type of cabinet.

But liquor cases are not limited to cabinet conversions. Another one was taken apart and turned into the spice shelf unit. Free wood has an added advantage over the bought-for-cash variety—the thickness



▲ *Fit doors in place, planing edges to secure fit with about 1/8-inch clearance.*

▲ *Measure up from the floor to locate both of the door pulls at the same height.*

▼ *Remove hardware, apply stain with cloth to match tone of different panels.*

▼ *Record-storage cabinet from imported cheese crate cost about $1, with top.*

is one you can't buy at the lumberyard. With purchased lumber your cabinet would have to be made up of thicker material, and would have a heavier, less attractive appearance. If you want still thinner material, ask your grocer to save you an orange crate. These are made up of very thin slats, handy for use where a part must be flexed or bent. And they're especially useful in building a toy boat for the small fry.

If you need a storage spot for your spices, use the jars to set the shelf spacing

If crate lumber shrinks after chest is built, nail filler strips under the seams.

Finished chest, formerly a lowly fish crate, makes a handy extra seat-bench.

Chest provides extra storage space for blankets and linens. Note the partitions.

Liquor case plus top, feet and hardware equal an end table-storage cabinet.

and allow about half an inch gap as a minimum between jar tops and the shelf above—more if you do not need to make every inch count. Mount your shelves so they slant slightly backward. This assures that jars will not vibrate out and fall off if you have a washing machine or dish washer that gives your kitchen the shakes. If the jars are tall, use a little "guard rail" on the shelf.

To make the traditional scroll-sawed top, simply make a pencil mark in the

center of the piece of crating you will use for it, then use a pair of pot lids in contact with each other as guides to the curves on each side. If you want to be sure of symmetry, mark the curves on one side only, then cut off the waste piece along the curved line. Use the waste piece as a pattern to draw the line on the other side and you are bound to have matching curves.

The best way to mount a set of shelves for this purpose is by driving a nail top and bottom through the back of the unit into a stud in the wall. You can usually locate a stud by tapping the wall lightly with a small hammer—or you can use one of the many types of "stud locators" sold in hardware stores; they are handy tools to have.

In all these projects, there is a useful point to keep in mind. The parts of a carton or crate can often be used in such a way that a minimum of cutting is necessary. For example, if you use the top or bottom of the carton full width as the back of your project, and if the height is not changed, all original material from the carton will fit together in the new form almost like a kit. You will be cutting only where you want a fancy curve or an added part. In most liquor cases you will find still another handy feature: the strips that make up sides, bottom and lid are usually joined with miniature tongue and groove edges. This makes a simple job of re-using the panels in other forms. You will probably have to pry out a few corrugated fasteners and some special corner prongs designed to keep the liquor safe from theft during shipment. But with a screwdriver, hammer and pliers, it is a quick and easy job.

How do you find crates? Appliance dealers, grocers, supermarkets and package stores are a good source. Disposing of crates and cartons is actually a problem for many of them and you will usually find the management happy to have you take some away. Keep in mind, however, that other customers of the same store may have asked for some, and a few types of shipping cartons and crates must be returned. (Wooden cases for milk and beer are examples.) But you will not find crate and carton material hard to get. In a single afternoon one do-it-yourselfer acquired enough to panel an entire room, and one of the most famous restaurants in the east coast area gathered much of its original fame from its walls—lined completely with lumber from old crates. G.D.

See also: FINISHING, WOOD; FURNITURE, USED; WOODWORKING.

SAMPLE WOOD CONTAINER SIZES

Product	Outside Dimensions	Wood Thickness
Scotch whiskey	9 x 12 x 17″	3/8 and 1/2″ (1/4″ lids)
	10 1/2 x 13 1/2 x 14″	3/8 and 1/2″ (1/4″ lids)
Imported cheese (wholesale)	13 x 24 x 28″	1/2″
Wholesale fish	13 1/2 x 22 x 45″	1/2″
Imported wine	8 1/2 x 13 1/2 x 20 3/4″	1/2″
Canned corned beef	7 1/4 x 7 3/4 x 15″	3/8 and 1/2″
Nail barrel	12″ dia. 17″ high	

GENERAL: Slatted crates and wood-framed corrugated cardboard crates and cartons are usually of 1/2 and 3/4″ lumber. Typical slat widths: 4 to 7 1/2″. Where a crate is made up of two different thicknesses, the ends are usually of the thicker material to simplify nailing of sides, top and bottom. Plate glass and pallets for shipping cement bags, blocks, etc. come in a wide variation of sizes, usually 3/4-inch thick.

Convenient Storage for Extra Lumber

Once you find some room, follow these easy directions and build a storage rack which will also help preserve your lumber

THERE'S A KNACK to storing workshop boards and plywood. First, you must find storage room—within handy reach—in a workshop usually crowded with tools (and projects waiting for you to fix). Second, the lumber must be stored so that it is not damaged by moisture and heat.

The suggestions given here have worked well for others, and they should help you with the problem of finding space where none appears to be. As a general rule, it is best to store lumber horizontally, so that the weight of the boards helps to hold them flat. Vertical storage of the boards subjects lower and upper ends to differing climates, and some warping strain from weight, but limited space may make it necessary. Vertical racks are convenient.

Boards should not be laid directly on a concrete floor, where seepage or condensation might upset the moisture balance of the wood. Nor should they be stored in the super-heated air under a hot roof, which may cause checking. Fortunately, it is not hard to rack your lumber above the floor, and most home shops are not too hot and dry at the ceiling.

Lumber racks can usually be spiked directly to frame walls by driving nails into the studs. In masonry, either nail them into wood plugs driven into holes made in the mortar with a star drill, or use masonry anchors.

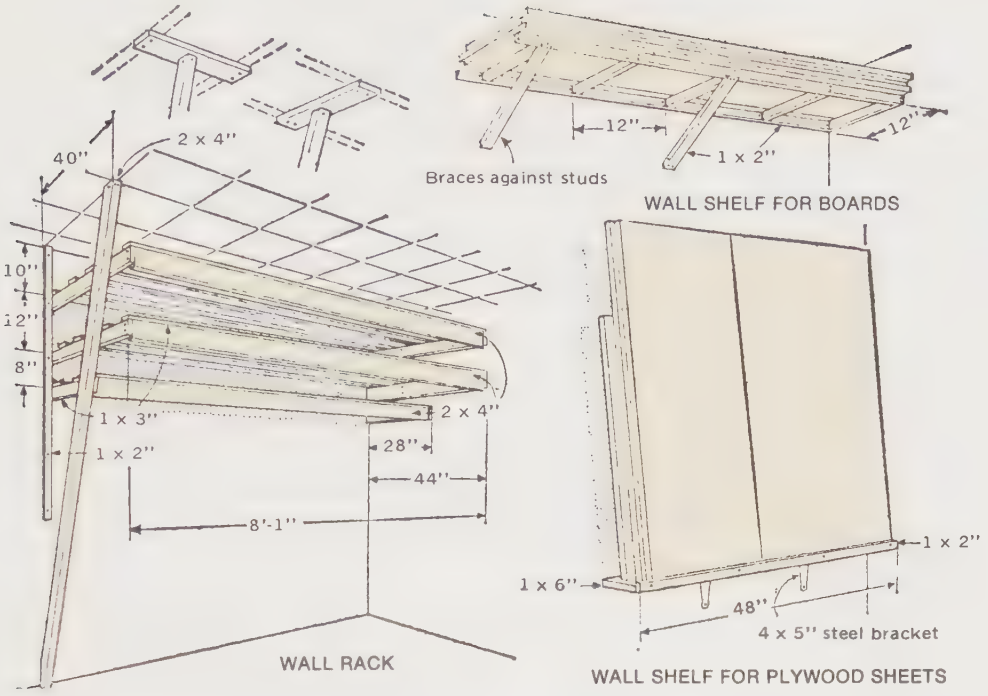
One rack affords handy flat storage, where materials can be slid in or out from the front. Being located above the height center of the wall, the shelves leave the wall free for a bench or a machine. To accommodate a full plywood sheet the inside length is a little more than eight feet. You can nail the foot of the sloping support anywhere along the sole plate, but if the upper end cannot be spiked to a ceiling joist, use a cleat bridging two joists.

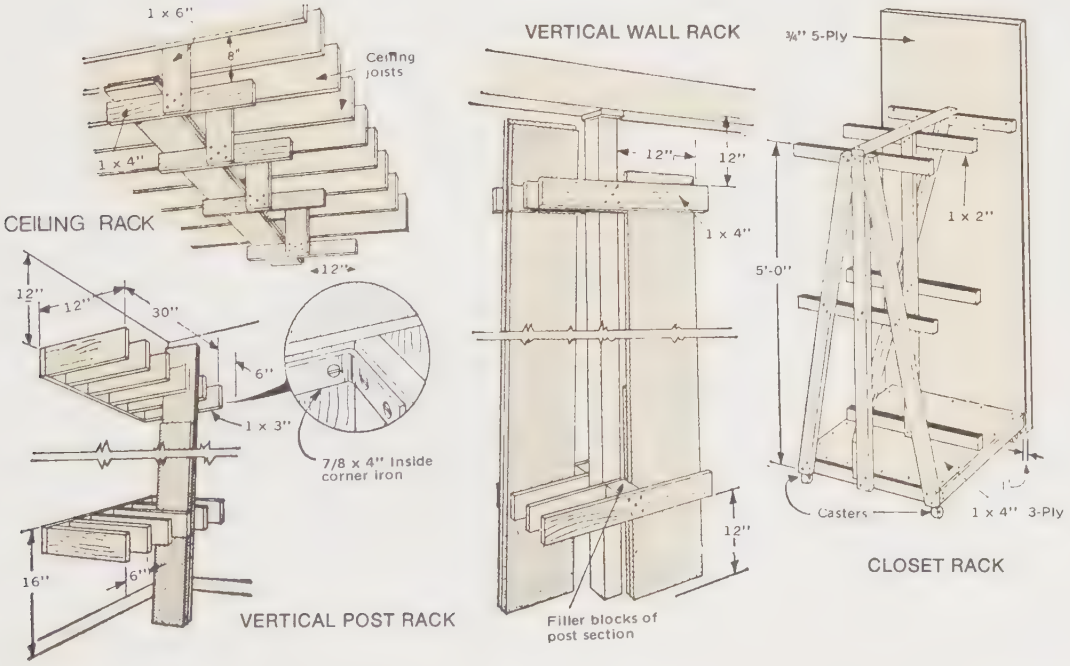
Nail up a vertical wall cleat to carry the shelf supports, or rest them on cleats spanning the studs. Strip the shelves with 1 x 3-inch fir.

A single, ladder-like shelf built from 1 x 2-inch strips mounted on a wall near the ceiling is one of the most convenient of lumber racks. As this space is likely to be free, the shelf can be extended for some distance for storing long boards. Or it can be used sectionally, with boards of one width piled together.

For storage of half-sheets of plywood or smaller, try a narrow-ledged shelf located on an upper half of a wall. Steel brackets, having no braces, conserve space by allowing a machine to fit snugly under the shelf. The nearly upright position of the plywood nullifies side stresses, helps the plywood to retain its flatness.

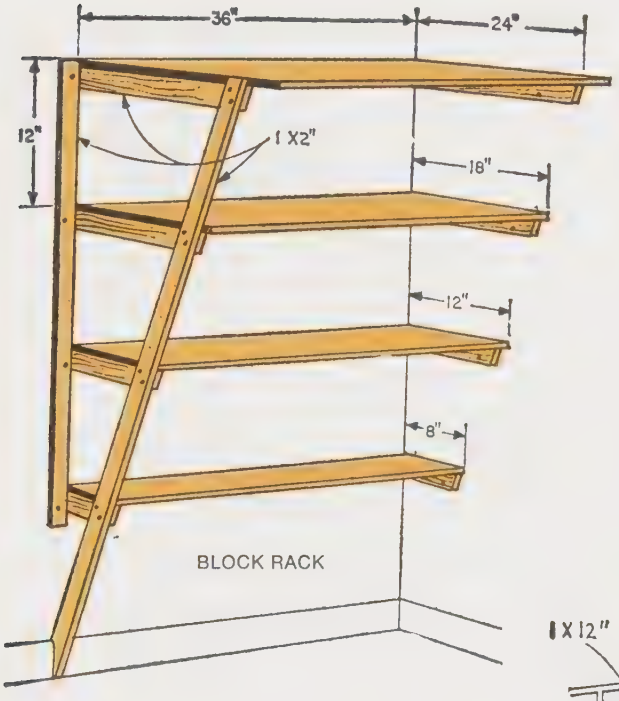
Where there is no wall space for a horizontal rack, try hanging a double-rack from


2 x 4"
40"
10"
12"
8"
1 x 3"
1 x 2"
2 x 4"
28"
44"
8'-1"
WALL RACK
Braces against studs
12"
1 x 2"
12"
WALL SHELF FOR BOARDS
1 x 6"
1 x 2"
48"
4 x 5" steel bracket
WALL SHELF FOR PLYWOOD SHEETS


1 x 6"
8"
Ceiling joists
1 x 4"
12"
CEILING RACK
12"
12"
30"
6"
1 x 3"
7/8 x 4" Inside corner iron
16"
6"
VERTICAL POST RACK
VERTICAL WALL RACK
12"
12"
1 x 4"
12"
Filler blocks of post section
¾" 5-Ply
1 x 2"
5'-0"
Casters
1 x 4" 3-Ply
CLOSET RACK

the ceiling joists. Nail the hangers to the joist sides, and then the crosspieces to the hangers, thus providing for boards to be laid on from both sides. On covered ceilings, attach the hangers to the ceiling with iron inside corners. Avoid heavy loading.

When horizontal racks are not possible, find a corner for vertical lumber storage. Two sets of spacers or fingers built of 1 x 3-inch stock support a few boards in each pocket; an added center set will take care of short boards. Iron inside corners hold the spacers rigidly, if placed near the upper edges and secured with stove bolts having washers and nuts sunk flush in counterbores. Attach the backs of the racks to the wall with lag screws or substantial masonry anchors.



BLOCK RACK

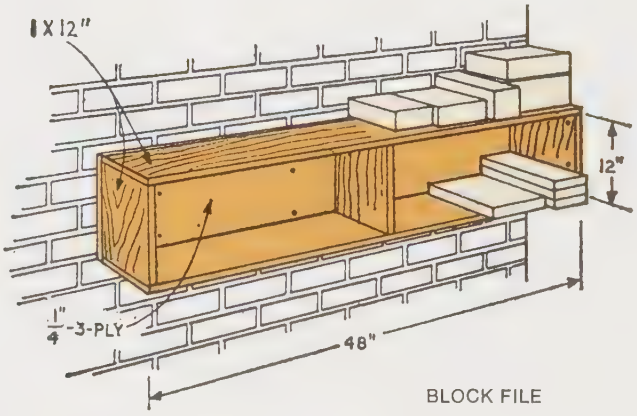
If your shop has columns supporting a girder these may be converted into vertical storage racks, using spacer blocks cut from beams of the same size as the posts.

Basement shops occasionally have closets opening from them, and these offer space for vertical racks on wheels. Build a base frame of 1 x 3-inch strips 2 inches narrower than the opening. Brace in both directions. Such a rack not only rolls out easily for access, but can be moved to the point of use. Attach plate casters with 1¼-inch wheels to corner blocks set under the platform.

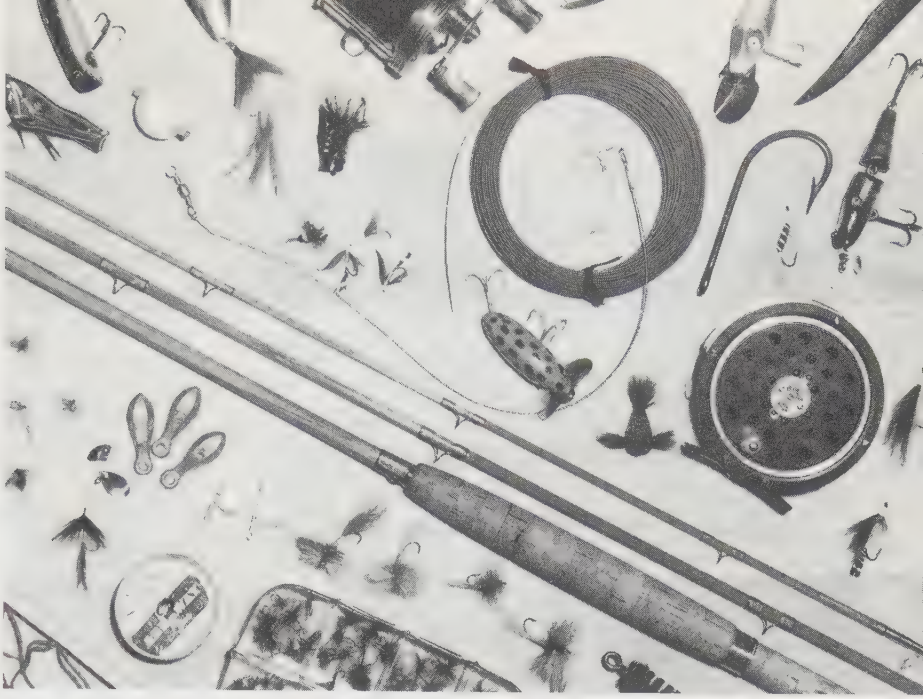
But what about short boards and blocks? Tossed in a box, these become hard to sort. Why not have a short three-decker rack, which gives you a visible file system. Range the pieces from small to large and according to thickness and width, with lengths appropriate to the shelves. Stack woods of a kind together, ends out. With this setup, loose blocks are easily stored.

Another idea for a small block file is a rack made of 12-inch boards having a plywood back. It is attached to a wall with nails or anchor screws driven through the back. Adapt the length to your available space and locate it conveniently.

See also: STORAGE; WORKSHOP.



BLOCK FILE



Spread out lures and tackle on your workbench, then take items one by one and give each a good overhaul.

Overhauling Your Fishing Lures

The wise angler spends spare time checking gear and making necessary repairs; it's easy if you have a little imagination

IT IS AMAZING what a little sandpaper and steel wool, a pair of pliers, a dab of paint and some clear lacquer can do to restore your tackle to store-bought newness.

With modern, quick-drying paints you can change the lure's design in a matter of minutes. Many old-time anglers even carry along some quick-drying paint as standard equipment in their tackle box. They do this to change designs and color schemes on their plugs while on a stream or in a boat, frequently changing colors until they hit a winning combination.

The best way to obtain a professional appearing job, particularly on a lure that has been considerably battered, is to sand off all old paint. This sanding will also smooth out most of the nicks and scratches on the lure's body. With the sanding completed, it is a good idea to give the plug an undercoat of white paint and allow it to dry thoroughly before you apply your designs.

The choice of colors you apply to your plug is part of the pleasure you derive in the rejuvenating process. Get at least six colors, including the three primary colors (red, yellow and blue), plus a small bottle of solvent. In painting your lures, you have unlimited color possibilities. Allow your imagination to run freely. Veteran anglers know that fish are unpredictable and will often strike only when a lure is painted a certain color.

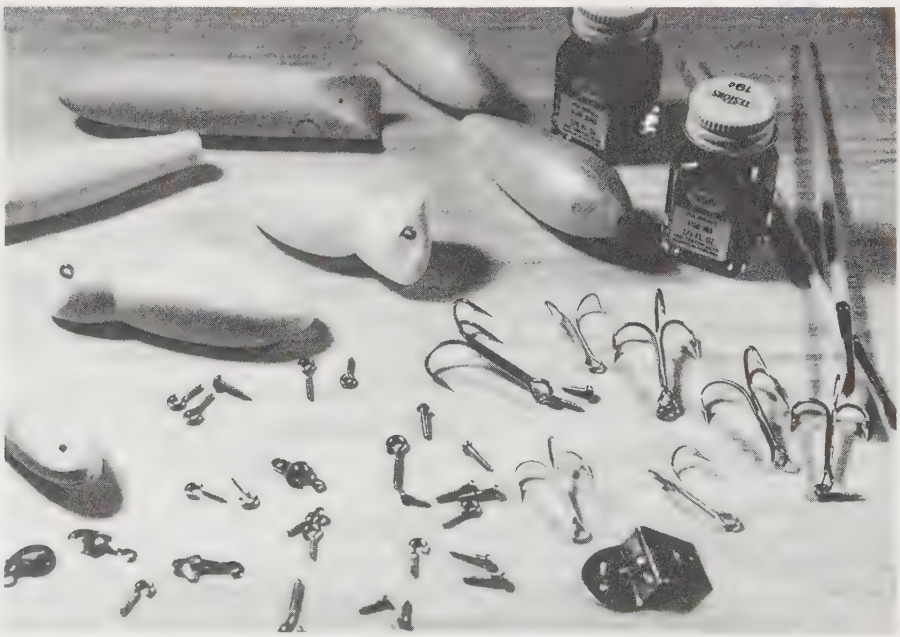
Fish-scale effects (actually a mottled appearance) can be obtained by painting through a piece of screen material. One way to produce spiral effects is to wrap a heavy string around the plug, holding it tightly in place and then brushing in your selected color at the open slots for a ribbed appearance.

machine boring: see drill press

For a perfect edge where colors meet, use masking tape. Make certain that the paint dries completely before you remove the tape, or you may get a ragged edge on your paint job. A good tip is to press the edge of the masking tape firmly against the plug with your finger nail, so no paint will seep underneath, resulting in a sloppy job.

Use your imagination in creating new and unusual designs for your plugs. The fish will not know—or care—if you are not as good as Michelangelo or Picasso. To create new designs, make a paper template and cut the design with the point of a sharp knife or razor blade. Make sure your template edges are neat and straight; fuzzy edges will mar your painting efforts. Hold template firmly in place, then paint in your design.

As you go about transforming old lures into fancy dressed-up jobs, you should remove all hardware from the plug's body. If you cannot remove the hook-up eyes of the lures, or the eyelets from which treble hooks hang, try not to splash paint on these. If by accident you spot a dab of



Tighten all screws and eye-screws on plugs. Sharpen hooks and use touch-up paint to cover chipped areas, especially those made of wood to keep the wood body sealed against moisture.

On badly chipped plugs, remove all hardware. Sand off old paint down to bare wood. Repaint to your favorite color and pattern.

After sharpening all treble hooks, wrap tape over barbs. Tape is easily removed, but while in the tackle box, points will not dull.

Old chipped lures repainted are good as new. Pressurized cans of paint are great for touch-up painting.

Use silver polishing cloth, or other polishing material, to brighten metal spinners.

A coating of clear lacquer (nail polish) will keep polished blades of spinners from oxidizing and tarnishing.

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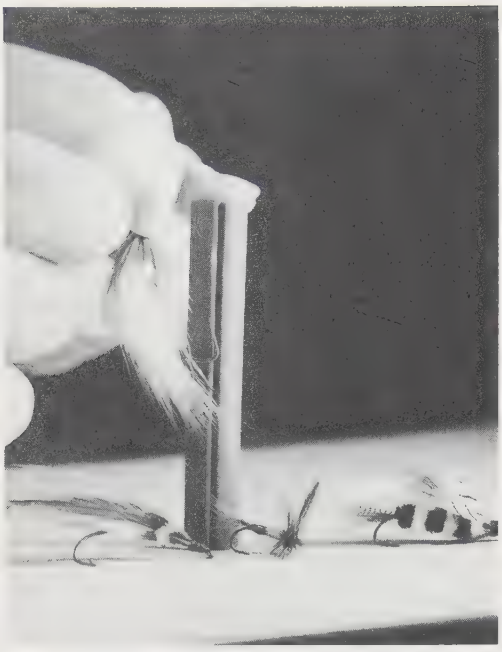
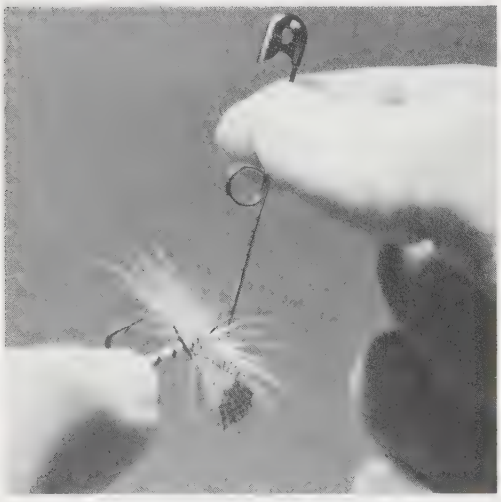


Check each fly hook, sharpening points of any that have been dulled or bent.

Steam from a boiling kettle will rejuvenate matted flies. Steam straightens tails, causes hackles to fluff up. In short, the fly looks like new and is ready for another season.



A drop of lacquer over thread wrapping at eye of hook will prevent old flies from unraveling. After lacquer has dried, clean out eye with point of safety pin.

Point of safety pin is not only great for cleaning out eyes of flies, but for a host of other tasks like untangling lines in reels. Some fishermen claim that a safety pin is one of the handiest items in a tackle box.

➢ *After steaming and sharpening flies, add moth crystals to the container if they are going into storage for any length of time.*

➢ *A good method of storing feathered flies is in a jar with mothballs. No danger then of moths and other insects dining on the valuable feathered hooks.*

➢ *Before old faithful patterns completely unravel, tie new ones using the thread-bare lures as models. If nothing else is at hand, substitute a "C" clamp for the vice to hold the hook firmly while dressing it with feathers and yarn.*

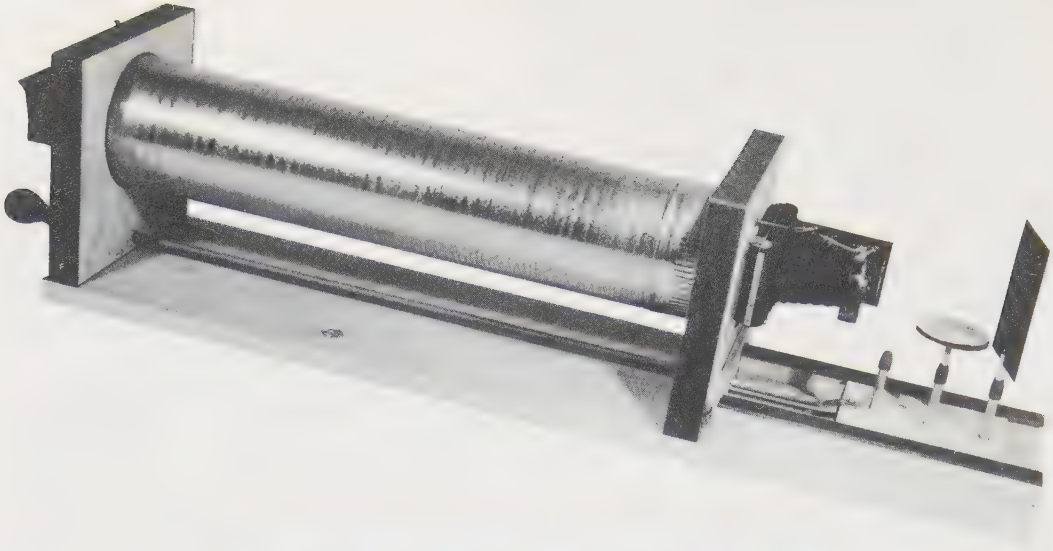
paint on your hardware, clean it off immediately. It is a tedious job to do it later. If you allow this paint to congeal it will hamper and interfere with the free-swinging action of your hooks and will not allow your lure that positive action which attracts lunkers to strike it.

Steel wool can easily remove the tarnish and rust off spoons, and a dip in fast-drying lacquer will not only give a protective coat but make them glitter like new.

Sharpen the hooks so the big ones will not get away because you offered them a dull barb. If they are rusted, or very bent, replace them with new ones.

If your flies are matted, a few minutes in front of a steaming coffee maker can restore them to their original newness. Keep working the fly until it is fluffy, as it should be. P.C.

See also: BASS FISHING; FISHING; KNOTS; TROLLING TECHNIQUES; TROUT.



Join the Small World of Macrophotography

You can easily take superb photographs of small objects with this inexpensive camera extension

IF YOU HAVE NOT YET tried macrophotography, as an adjunct to your normal scientific pursuits, you may have been missing out on some pretty exciting experimentation. This branch of photography is at once a fantastic information gathering process, and just plain fun for its own sake.

Through macrophotography, an entomologist can learn more about insect anatomy than he could by reading reams of dry text. The botanist can discover a multitude of fascinating structural forms in all kinds of plant life. The chemist can make superb records of crystal structures and other physical forms. A pathologist can use the techniques to make enlarged pictures of specimen slides.

Macrophotography offers something of value to virtually any scientific specialist, and since even scientific laymen are inevitably fascinated by photos that reveal clearly the small, unseen things about them, macrophotography is a sure-fire way to make an otherwise dull science fair exhibit come alive through spectacular displays.

Macrophotography is simply the process of taking larger-than-life pictures, using ordinary cameras, of subjects that are too large for photomicrography and too small to be conveniently photographed with only supplementary close-up lenses. The usual magnification range is from one to ten diameters; but though ten diameters is generally considered to be the practical limit of macro-magnification, this applies only to magnification on the negative. By means of normal enlarging processes, the final magnification can become much greater.

The basic principle of macrophotography is very simple: you merely extend the distance from the camera lens to the film to create an enlarged image. Special cameras having double or triple extension bellows serve well up to a point. However, most experimenters want greater magnifications, and want to obtain them at low cost. So the answer is to use ordinary camera equipment that can be modified.

This is done by interposing a light-tight

magazine table: see tables
main shutoff valve: see plumbing

tube between the camera lens and the film plane. The tube can be constructed of wood or metal, or you can use a long bellows (as from an old 8x10 studio camera) should one be available.

Stovepipe saves time. Your local hardware store can provide a 5-inch diameter, 2-foot long galvanized stovepipe at small cost. This is ideal for the body of the camera because it is of convenient length, sturdy, attractive, and easy to fit to the two end pieces made of wood. The stovepipe requires no alteration except painting on the inside with flat black paint, most conveniently appied with an aerosal spray can.

Start construction of the end pieces by cutting two 9-inch squares from ¾-inch thick pine. Make sure that the corners are squared properly. Into each, cut a 5-inch diameter hole to provide a tight fit with the stovepipe. Position the hole so that its center is about 3½-inch below the top edge of the panel.

Along the bottom of each panel, attach a 1½-inch high strip of wood also cut from ¾-inch pine. Notch this to a depth of ¼-inch so that it can accept the lower edge of a ½-inch thick plywood panel (see diagram).

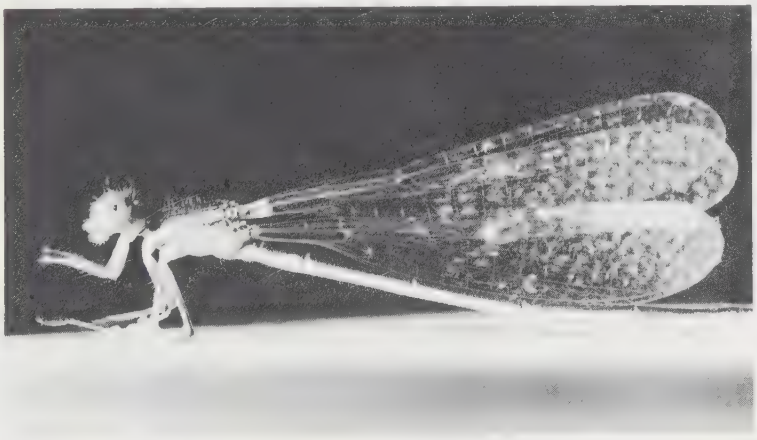
Along the top and sides of the two end panels glue and nail 1¼-inch wide strips cut from ⅛-inch thick Masonite. The extra width projects toward the same side having the bottom pine strip just mentioned.

From ½-inch thick plywood, cut two panels that will drop snugly into the notches on the lower strips, and fit snugly into the recessed areas formed by the top and side strips as shown. When these panels are in position, mark the locations of the stovepipe openings. Also, drill a small hole through the center of the top edging so that it extends into the top edge of each plywood panel; by dropping a metal pin (nail or small bolt) through these holes, the panels are locked firmly in place, yet each can be removed in an instant.

The stovepipe is fitted into the end pieces which are then fastened to a baseboard about 9¼-inch wide and 37½-inch long. Make the base from ¾-inch thick pine that is flat, not warped. Square the end pieces carefully so that they lie in parallel planes.

Before mounting the end pieces, drill a hole in the center of the lower edge of each to accept a metal rod about 33 inches long; a metal tube, about ⅜-inch in diameter, salvaged from an old TV antenna is also good. This is the focusing rod that is used to adjust the sliding block.

Sliding block. The sliding block (pine) should move easily but not too loosely between the guides at the front end of the



An entomologist's dream, this damsel fly is enlarged to the point where the smallest feature is distinguishable.

You do not have to be an entomologist to appreciate the insight this photograph gives into the pain a bee has often caused you.

The biologist, amateur or professional, can learn a great deal about germination of small flowers from close-up photographs.

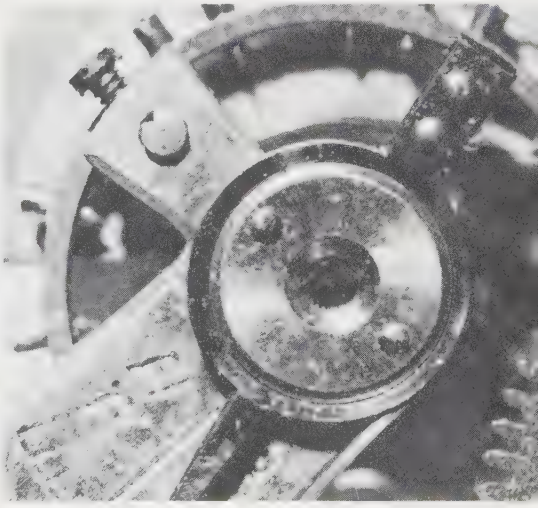
A fascinating view of the balancing wheel of a wrist watch.

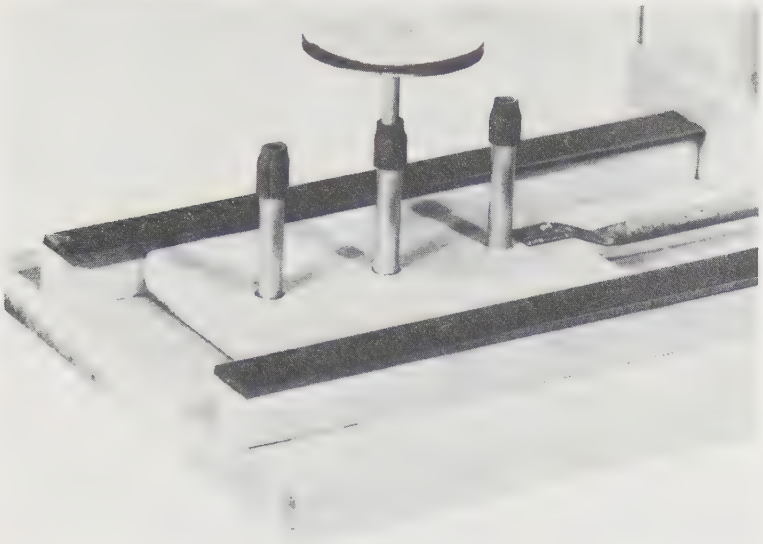
baseboard. The construction is shown clearly in the photos and diagram. On the block mount three 3-inch metal tubes (from TV antenna), spacing them about two inches apart. Wood dowels, about 3½-inch long, slide up and down inside these tubes, and are held in place by short lengths of rubber tubing, as shown. One dowel supports a specimen table about 2⅝-inch in diameter. Cut this from ¼-inch thick plywood.

Hacksaw a ½-inch deep slit into the end of one dowel into which cardboard backgrounds can be inserted. The table can be located in any of three positions, whichever provides the best spacing from the camera lens to the subject.

Camera mounting. Virtually any camera from a 35mm to a folding camera having a 3-inch or 4-inch lens can be used. Just cut an appropriately sized and shaped opening in one of the plywood panels, and devise some sort of support, clips or springs to hold the camera firmly in position. No exact specification can be given because so many different types of cameras are likely to be used. The important thing is to mount the camera firmly, and to make the mounting light-tight.

Strips of foam plastic or foam rubber, of





Specimen table can be moved to any of three positions on the sliding block to provide the most convenient spacing for whatever camera or lens is used.

the type used as cushioning pads under carpets, can be glued around the plywood panel opening to form a light-tight seal even if the camera back is not perfectly flat. The rear cover of the camera must of course be removed (or at least opened), before mounting.

Instead of using a camera, you may have, or be able to obtain at small cost, a used lens/shutter combination similar to the one shown. Mount this on a separate panel. You can thus use any number of cameras and lenses having different focal lengths to obtain different degrees of magnification as your photo projects may warrant. Because the panels are easy to interchange, shifting from one to another is fast and simple.

Film holder. The rear end panel must be fitted with a film holder and a ground glass for focusing. The ideal unit is a film pack and cut film adapter of the kind shown. Your local camera shop may have a used one at reasonable cost. Or you may be able to salvage one from an old press-type camera that is otherwise worthless. Such holders have a built-in ground glass.

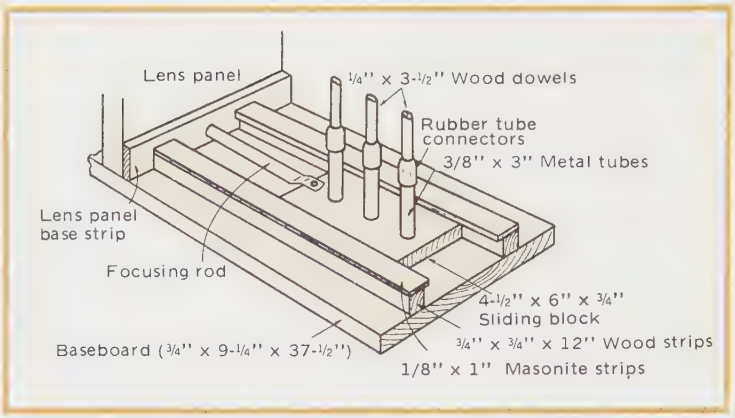
You can also use roll film, if you can purchase a roll film adapter sold for use with press-type cameras. In this case, you must provide a separate ground glass for focusing. First fit the film adapter to one of the removeable panels using blocks similar to those shown to provide a firm, light-tight fit. The adapter must, of course, be removable. Then fit a piece of ground glass into the opening, masking it with black paper so that its exposed area conforms with the film area of the holder. *Important:* make sure that the ground surface of the glass lies in exactly the same plane as the film in the adapter!

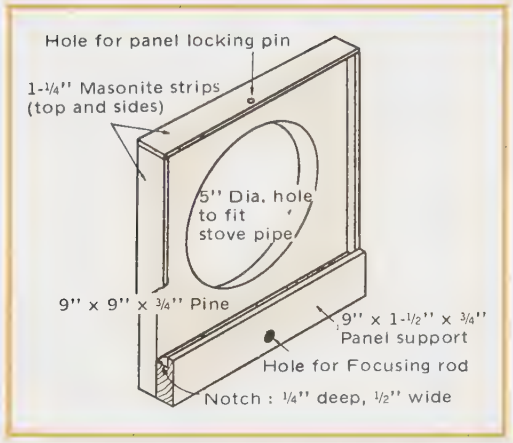
If your available photo equipment is meager, shop around for an old press camera in your local camera stores and perhaps even in pawn shops. From it you may be able to salvage a good lens/shutter combination and a film pack holder.

If you are short on money or cannot find any cheap second hand equipment, you can still make macrophotos although not as efficiently as you can with the proper equipment. Actually, you don't even need a shutter since most exposures will be several seconds long.

You can make the exposures, in a dark

Sliding section is about 12 inches long (entire baseboard 37 inches); 1/4-inch dowels fit into 3/8-inch metal tubes and are held in place with short lengths of rubber tubing, as shown.


Lens panel
1/4" x 3-1/2" Wood dowels
Rubber tube connectors
3/8" x 3" Metal tubes
Lens panel base strip
Focusing rod
4-1/2" x 6" x 3/4" Sliding block
3/4" x 3/4" x 12" Wood strips
Baseboard (3/4" x 9-1/4" x 37-1/2")
1/8" x 1" Masonite strips


Hole for panel locking pin
1-1/4" Masonite strips (top and sides)
5" Dia. hole to fit stove pipe
9" x 9" x 3/4" Pine
9" x 1-1/2" x 3/4" Panel support
Hole for Focusing rod
Notch : 1/4" deep, 1/2" wide

Make two identical end pieces. Lens panel drops into notch in the panel support. Extended Masonite strips at top and sides provide light-tight seal around panel. Note hole for locking pin that keeps panel in place.

room, by simply turning the subject illuminating lights on and off. And if you don't have a film holder, try this. Attach a piece of cut film to a slightly larger slab of wood (painted black) using adhesive tape or any other means to keep the film flat against the wood, emulsion side out of course. Put this into a light-tight box or drawer in your darkened room. Focus your subject onto a piece of ground glass (even tissue paper) placed across the opening of the rear panel. In the dark, replace the ground glass with the film block, then snap the subject lights on and off to make the exposure. Although this crude method is certainly not laudable in terms of working efficiency, it can provide excellent macrophotographs.

How good must the lens be? Obviously a really good lens will produce a sharper, more detailed picture than a poor one. But even a very inexpensive camera lens will yield remarkably good results because you will ordinarily stop down to about *f*/16 to obtain sufficient depth of field.

How much magnification? The ancient folding camera shown in some of the photos has an *f*/6.3 lens with a focal length of 100 millimeters (4 inches). The bellows of the camera extends the lens to film distance to about 30 inches. This set-up provides a magnification of about 7X in terms of the picture diameter, or 49X in terms of the picture area covered. A specimen about ½-inch long would provide an image 3¼-inch long.

Inexpensive close-up lenses that fasten to the regular camera lens can be used to further increase the degree of magnification. For example, a 3 diopter supplementary lens will boost magnification to 10X (diameter) or 100X (area).

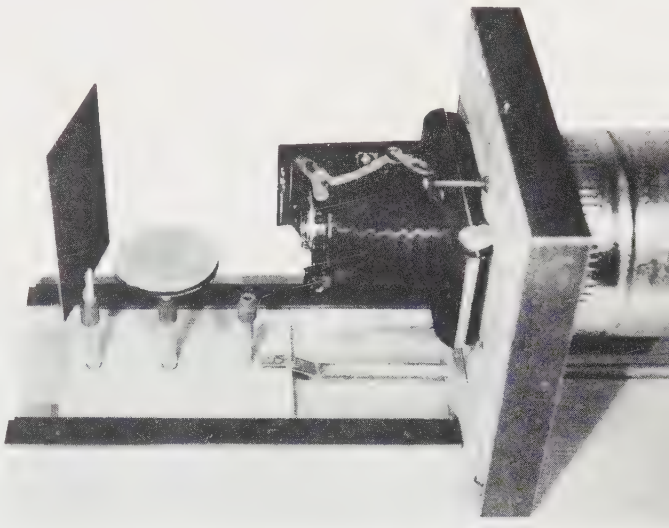
A better way to increase the magnification is to use a lens having a shorter focal length. The 50mm lens used in a 35mm camera will provide a more than adequate degree of magnification.

There is one more way to increase magnification. By increasing the length of the stovepipe. It might also be feasible to use stovepipes having different diameters so that they can be made to telescope, thus giving a system in which the lens to film distance can be varied to provide different degrees of magnification with any one lens. Just remember that too much magnification brings new problems; the most serious is the considerable shrinkage of the depth of field—the front to back region of the subject that will be in focus. Start with the design shown here; it is likely to be more than adequate for most purposes.

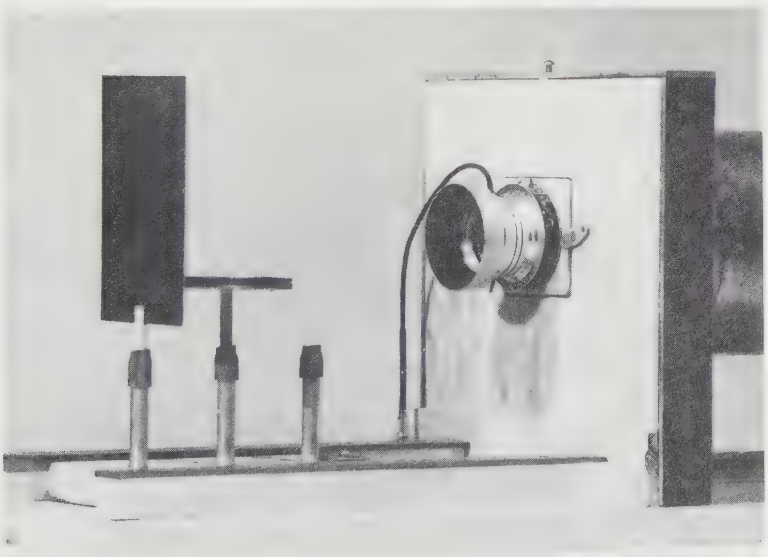
Exposure problems. No exact information concerning proper exposures can be given because they will vary greatly depending on the speed of film used, the intensity of illumination, the amount of magnification, and the *f*/stop used.

Incidentally, light the subject carefully using any convenient light source. Small spot lights are good, and you can even make good use of the strong light of a slide projector. Use metal or white cardboard reflectors to bounce light into shadow areas. You will find that shadow illumination is much more important in macrophotography than in ordinary picture making.

Your photo shop can probably provide booklets, or your library may have reference works that tell how to adjust exposures when making pictures using extended lens-to-film distances. These are quite helpful, but the best and quickest way to solving exposure problems is by trial and error. In the first place, it is very hard to take a



▲ *Camera secures on one end piece.*



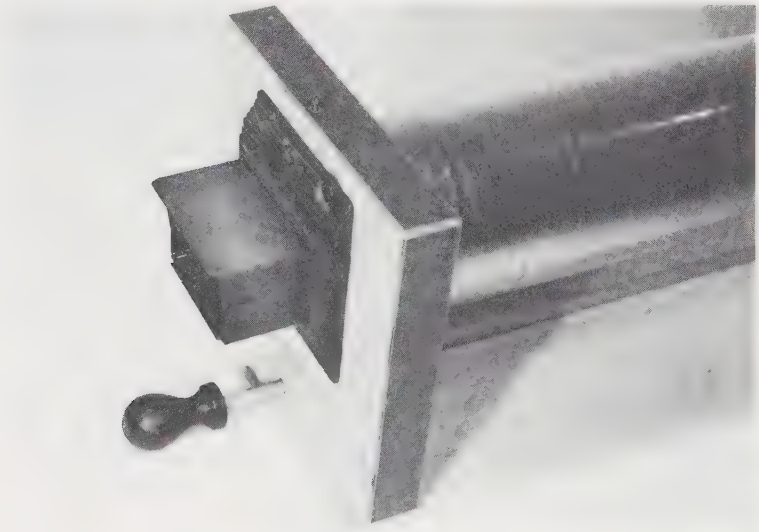
◀ *The lens and shutter from a press camera mount easily onto a separate lens board. Note the metal swivel locking pieces used to hold the lens plate in position. Virtually any camera can be used; devise an appropriate locking device.*

meter reading of the light reflected by, say, a small bug. Even if you can, you will probably find that your first exposures are not perfect despite the use of all the proper mathematics to recalculate to allow for the increased lens to film distance.

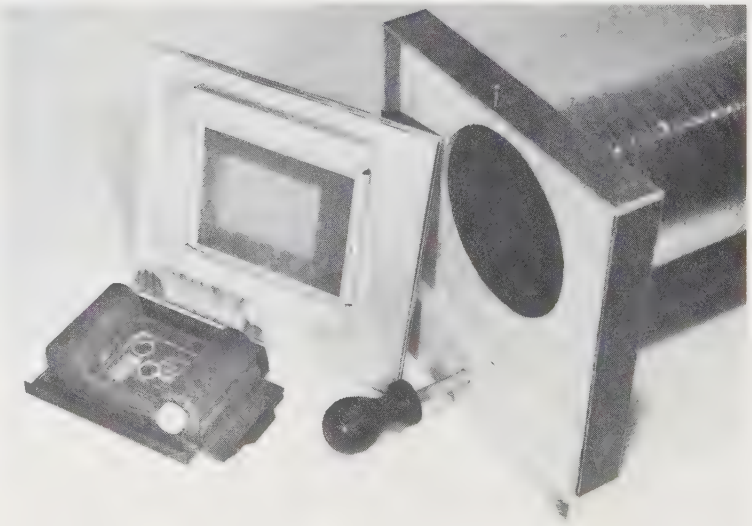
Stop your lens down to *f*/16 or smaller, after adjusting the illumination and focusing the subject. Then make a number of test shots using arbitrary exposures ranging from $\frac{1}{25}$th of a second to perhaps several seconds. At least one exposure is likely to be in or close to the perfect-exposure ballpark. Keep records of exposures and lighting conditions used to photograph different types of subjects; after a little experience, you will be hitting the proper exposures with relatively little difficulty.

When you reach this level of technical expertise, you can devote your time to finding interesting photo subjects and composing them into striking compositions. They are everywhere, and of infinite variety. If you are a photo hobbyist as well as a budding scientist, you will also find in macrophotography a fascinating new area of photography for photography's sake. You may win prizes at your next science fair, and perhaps at your local camera club contest as well!

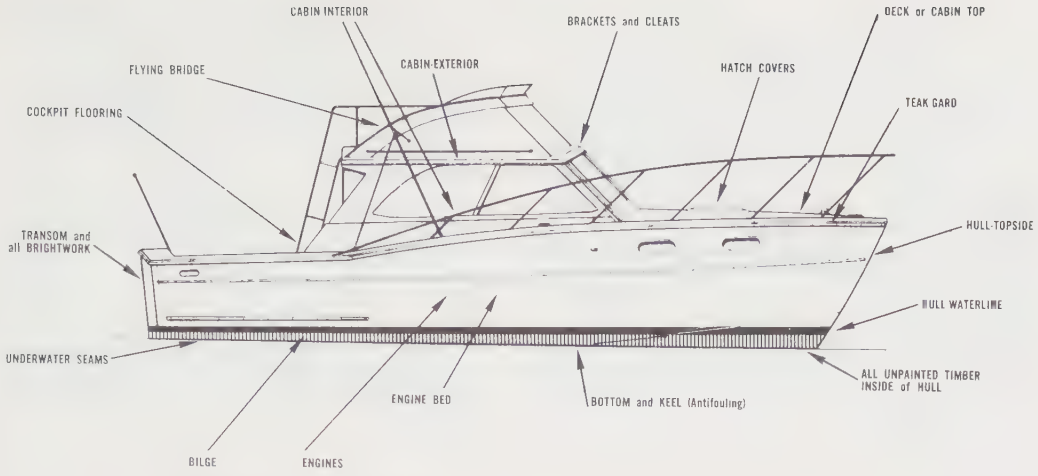
See also: DARKROOMS; PHOTOGRAPHY; PHOTOMICROGRAPHY.



Film pack holder with built-in ground glass and hood is most convenient for focusing and holding film. It also accepts cut film holders. Note knob on focusing rod. Rod runs the length of the base to the sliding table—pull or push table until object is in focus on ground glass.



Low-cost roll film holder fits between retainer blocks on panels. A separate ground glass, masked with black paper, is used. The inside of the stovepipe, the two end support pieces, all lens and film panels are painted flat black to minimize reflection. (Photos were made before painting to reveal the construction details.)



Major points to paint in a spring reconditioning of your boat.

Giving Your Boat a Spring Painting

Knowing where to paint and what to use will guarantee you a summer of satisfying and enjoyable boating

OLD SALT OR NEW, you can gain a few weeks of extra time to paint your boat if you plan your hull reconditioning program early in the spring. As soon as weather permits, check all painted and varnished surfaces carefully, from spar top to keel line, hosing down the exterior with fresh water. On cabin craft, assure as much free circulation of air as possible throughout the hull. Foul, stagnant air often promotes mold and mildew.

All checked, cracked, blistered, peeled, or scaled paint should be removed thoroughly, with particular attention to parts of the hull below the waterline. The secret is to get down to a good, sound surface before you even think about applying new coats of paint or varnish, for the final finish will be only as good as the substrate on which it is coated. Be sure that all surfaces are free of dirt, grease and oil. Sandpaper wood surfaces to remove imperfections and insure adhesion over old finishes.

Remove rust from metal surfaces by sandpapering or wire brushing, and then wash the metal with mineral spirits, kerosene, or washing compound and prime. Carefully caulk all seams, sanding down the newly applied material to get a good, smooth surface.

There are some important rules of sanding. Wear a gauze mask; most paint dust is toxic, expecially dust from bottom paint. Do not use steel wool—tiny particles imbedded in the surface will eventually rust through the paint. Always sand with the grain. Do not leave bare wood exposed too long as it will absorb moisture. Practice first on a piece of scrap wood, if you have never used a sanding machine before. Never use a machine sander between paint and varnish coats. Applying too much pressure

maintenance, camping gear: see camping equipment

Be careful not to hold electric sanders too long in one area.

Sanding blocks can be quickly made by wrapping sandpaper around a block of wood.

with a machine sander will glaze the surface, or the frictional heat may soften the paint or varnish and "load" the sandpaper. And never sand if someone near you is painting or varnishing.

Once the surfaces are ready for refinishing, begin work at the top and work down for best results. The usual order is standing spars, cabin exteriors, cabin interiors, decks and deck equipment, topsides, bottom and finally, boat topping—although if you are anxious to launch the boat, you can just as well start with the hull and then proceed to the rest of the topside work once you have it in the water.

For best results, aside from starting with a good, clean surface and the best materials available, the most important thing to remember is to wait until the temperature is above 55 degrees before you begin painting.

Bare iron or steel surfaces should be primed with a good red lead or zinc chromate primer which provides an excellent foundation for finish coats. On galvanized surfaces, use a primer formulated for use on that type of metal. Fast-drying, hard-surface alkyd enamels, available in many colors, in addition to white and black, make excellent long-wearing, weather-resistant topside finishes.

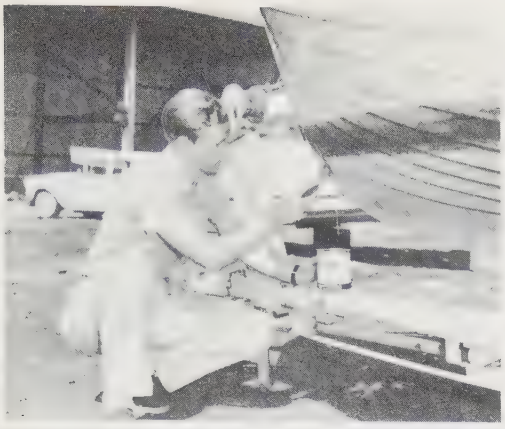
Hulls require extra care if the boat owner is to get not only the ultimate in protection but also a sleek, clean surface that provides a minimum of resistance or friction in the water and thereby contributes to the craft's speed. Where marine growths or algae are a problem, use an antifouling bottom paint, available in such attractive colors as bright blue, sub-marine copper bronze, red, green, copper red, and vinyl red.

Almost all shipworms (borers) and fouling organisms live in shallow salt water along the coastline and tidewater river banks. Fouling will not occur in strong currents, or when the boat is moving. Therefore, most fouling occurs while the boat is moored in salt water that is fairly stationary.

The temperature, saltiness, pollution and movement of the water are the principal factors that determine the fouling rate. In addition, there is a wide variety of fouling organisms in different locations.

One type of antifouling bottom paint is formulated on the well-known eroding principle, which means that it "sloughs off" or erodes at a controlled rate to prevent the build-up of marine growths. A second type is based on a vinyl formulation that provides a tough, flexible film approaching that of hard racing bottom paints. Both types contain ingredients which keep active toxic materials on the paint surface in sufficient quantities to control marine growth effectively.

There are many causes why good anti-



Putty knives are most useful for applying seam compounds.

Always give canvas and wood trim a sealing coat before winter storage.

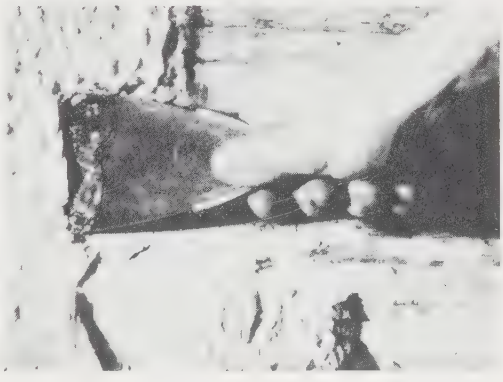
fouling paints sometimes fail. Of course, one is that the painter did not follow the directions on the can, but the application of one type of paint over an existing coat of different type can also affect the effectiveness. The difference in ingredients often cause the new paint to detach. This is true even though the different types are made by the same company.

Painting on an unsound surface will also be a factor, as will accidentally scraping the paint off while launching, striking underwater objects or scraping sand bars. Another important influence which can affect the success of antifouling paints is an electrochemical reaction between the paint and metal fixtures, such as fasteners on bottom wood planks which are improperly plugged.

Painting schedules should be arranged so that your boat can be launched within six hours, and never more than 24 hours, after application of the final coat of an eroding, antifouling paint.

Fiberglass bottoms, of course, require special treatment. Previously finished surfaces should be cleaned with a detergent or

Old salt or new, you can gain a few weeks of extra painting time if you plan on reconditioning your boat in the spring.



Paint and varnish remover should be used with a putty knife. Scape off the old coats while the remover is still wet. If you cannot get down to the bare wood, use a second or third coat of remover until you have a good, sound surface.

solvent wash and—if free from cracks, peeling or other film failures—refinished with fiberglass primer. This is a fast-drying material which should be sanded before it reaches ultimate hardness, usually within four to six hours. Any of the antifouling bottom paints can then be applied over it.

If fiberglass is applied to an old hull, allow the plastic to cure for five to seven days before applying any finish, then start with a fiberglass primer. Two or more coats of primer may be required to insure complete filling over nonuniform surfaces before the final antifouling paint is applied.

Vinyl bottom paint, incidentally, acts as its own primer on wood, and a minimum of two coats should be used on new surfaces, allowing one to two hours' drying between coats. On steel hulls, multiple coats of submarine zinc chromate metal primer should be applied before the vinyl bottom paint.

Paint and varnish failures in boats are caused by several conditions, both natural and unnatural, and are fairly easy to recognize. Checks are short, shallow, fine cracks in the finish. Cracks are the same as checks except they are long and deep and when the edges of cracks curl, the paint scales or flakes. Checking, cracking and scaling starts when the finish becomes brittle and can no longer expand and contract with heat and cold.

This condition occurs much sooner with thick coats and with inferior paints and varnishes. It also occurs when a finish is applied on the top of too many old coats.

Alligatoring, when the finish looks like alligator hide, is usually caused by applying paint over the wrong type of primer or sealer, or by applying the finish over an undercoat that has not dried sufficiently.

When the finish appears to be wrinkled, you can bet a coat of varnish was applied under the direct rays of the sun on a hot day. The skin dries first, and later, as the body dries, it contracts and wrinkles the top skin.

You will get blistering of a varnish or paint finish if you apply it on a damp surface —whether it be wood, aluminum, steel or fiberglass. Wood can be surface dry, but damp below the surface. Apply the finish and the trapped moisture will later rise underneath the finish, causing blisters.

In suction spots, more paint and varnish are absorbed than in other areas. This is most often caused by inferior paints or sealers, but it can also result from insufficient coats of paint. There are special clear sealers which will prevent high and low spots in the finish.

If the top layer of the paint is soft and washes away, the paint did not dry soon enough. You probably painted when the temperature was below 50 degrees or on a damp day.

There are many reasons for excessive chalking or powdering—inferior paint, application on a damp surface or when the weather is damp or foggy. However, mild chalking of paint is normal wear. In a good paint, chalking occurs at a predetermined rate. This actually cleans or gets rid of old, worn pigments on the surface.

The best way to rid the boat surface of these imperfections is to remove the old finish entirely. Paint and varnish removers work well on wood surfaces. Flow the remover on liberally with an old brush; do not brush on as with paint. After about 20 minutes, start scraping with a stiff two-inch putty knife. If you cannot scrape to the bare surface, apply a second or third coat.

After scraping to the bare surface, wipe off the remaining sludge with a wet cloth (covered with brushing liquid of some kind). Since most paint removing compounds vaporize quickly, open windows or doors when working indoors. Avoid breathing the vapor or direct contact with the skin.

See also: ABRASIVES; ALUMINUM; BOATING; PAINT; PAINTING.

Spring Check List for Your Boat

By planning and organization of your boat's spring fit-out, you can save time and energy in preparing it for the summer

WHETHER YOU OWN an eight-foot pram or a 28-foot cruiser or sloop, spring fit-out means a lot of work. Usually quite a number of things must be done, and many of these require special marine supplies which are not carried by the corner store. Whether you sail through in jig time or make heavy weather of it depends in large part on your management and planning. Organizing your time and work can put you on the water way ahead of the casual dabbler and make fit-out a lot of fun.

One of the hazards of spring boat work is the weather. Get set to paint or varnish and it is likely to rain, turn cold or blow in a pea soup fog. If your plans are well laid, however, you can turn to alternate jobs and make effective use of your time. One planning routine involves a small notebook, work clothes, screwdriver, steel tape, and pliers. Starting at the bow (or hitch if you have a trailer rig), look, test and probe. When you find something that needs attention, list the job on the left-hand page, while opposite put down the tools and supplies the work requires. The entry for the winch, for example, might read like this: "Rust on winch, line questionable, hook cutting line." Then opposite write down: "Wire brush, wrenches, penetrating oil, grease, aluminum paint, 50 feet of ⅜-inch polyethylene winch line, ⅜-inch thimble." Almost any weekend, even in snow, that winch could be pulled off, taken inside for an overhaul, and you know you would have everything needed to finish the job.

Go slowly and thoroughly as you survey your boat. Find trouble before it finds you. If you pretend it is a used boat you are considering buying, you will have the right attitude. Do not assume that things are all right because they worked well last year. During the lay-up period rust, rot and corrosion have a good chance to get started. Boats, like other machinery, deteriorate more when out of service than when in use.

When you have gone over it thoroughly, make up a purchase list and buy or order all the things you need. With everything on hand, you can tackle jobs in their proper sequence, as the weather and your mood dictate.

Getting help from boating buddies and family members speeds the job and serves to heighten their boating fun. Everyone appreciates a good boat more if they have had a personal hand in making it so. Add a

car washing wand to the end of the garden hose and even small helpers will enjoy the clean up, which is the first order of business. Scotch-brite nylon pads scrub without scratching and are great for caked-on deposits.

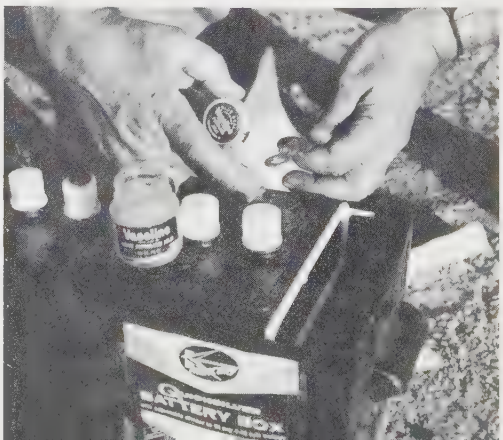
If your pride and joy is a sailboat, you know that the rigging must be inspected carefully, fittings tightened, cotters replaced, track lubricated, etc. Sail cleaning and repair usually is best handled by the loft, which has the machines and the know-how. Few sailors need reminders about questionable cordage. The loss of a sheet or halyard can be serious in the sailing world.

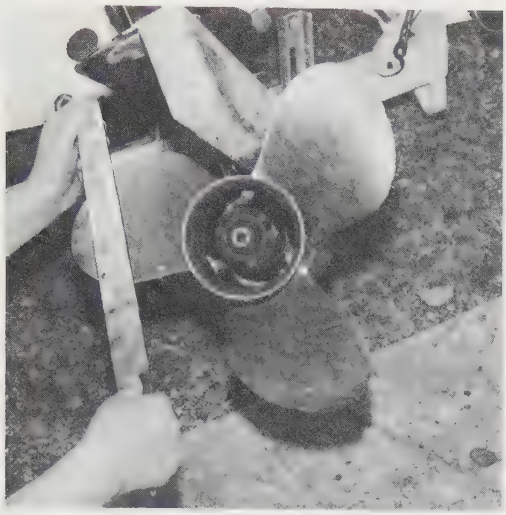
Engines are mysterious for some, simple for others. If you belong to the first group, let your dealer handle it. Even if you belong to the second group, you should limit your ministrations. Special tools, service manuals and experience are needed for most of today's sophisticated power plants. If you wrench up the head bolts too enthusiastically, for example, you can pull the studs right through the outboard block or crack the head. But you can tend to the basics. Fuel, spark, and compression are the three keys to gasoline engines. If your engine was running well and got a proper fall lay-up, spring work should be no problem. Start at the gas tank, using a flashlight to look for rust and gum deposits. Acetone or lacquer thinner plus some coins or good-size machine nuts (even pebbles) vigorously shaken will loosen the deposits. Go over fuel lines from tank to carburetor. Whether flexible hose or copper tubing, these just have to be right and tight. Cracked, leaky fuel lines and fittings deserve only one fate—discard them. It could be your life. Remove the fuel filter, clean element, and replace the gasket. A square bowl and gasket are good to have in your on-board repair parts kit.

During spring fit-out, the transom trough and engine should be thoroughly cleaned of all grease.

The ignition system is equally important and is the cause of many marine engine ills. Working in a moist, wet atmosphere, the wiring insulation has a tough job to do. Essentially, the electric cables and wires are pipe lines for carrying the power. Cracks which allow the current to escape will cause poor performance or stoppage. Bend the cables and wires in a tight circle and look for cracks. Have your dealer give the battery a break-down test to make sure it is healthy enough for the season ahead. Slow-charge it up to capacity, scrub the top with water and soda, then shine and Vaseline the terminals. Points, plugs and

Clean top of battery with water and soda, and grease terminals with Vaseline.





Minor nicks can be filed off the prop. Major repairs should be handled by pros.

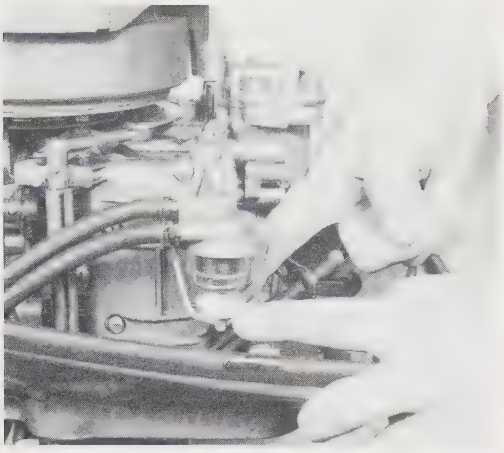
Fuel system must be in top shape. Check hoses for cracks; they can cause leaks.

Life jackets and buoyant cushions wear out —replace them.

condensers are inexpensive but vital. Unless you have worked on them before, better let the dealer handle them. Even though sparkplugs are spanking new, check the gaps against the specifications in your owner's manual and adjust them if necessary. Then install the plugs with a torque wrench.

Condensation frequently forms in the final drive, so top it off, even if you changed it in the fall. Some sterndrives have two reservoirs, so be sure to fill both. Inboard reverse gears also should get fresh grease each spring.

When a boat is idle, corrosion can form on the steering and controls. A stuck throttle or jammed steering can put you on the rocks, so clean, lubricate and tighten the whole system. Do not take chances here, especially with a fast rig. As a final



▲ *Clean fuel filter often. Dirty filter is a common cause of fuel shortage.*

▲ *A lambswool bonnet in a ¼-inch drill will produce a high-luster finish.*

▼ *Fiberglass hulls can often be put in top shape with wax cleaner and polisher.*

engine step, clean, repaint, or rewax the outboard. Clean engine rooms reduce fire hazard and help you spot water, oil, or fuel leaks in the early stages. Incidentally, check the new Coast Guard regulations and make sure your engine and tank compartments are vented properly. The new regulations will promote safer boating for everyone.

Unless the propeller is perfect, have the dealer set the pitch and fill in the nicks. Balancing a wheel helps restore lost performance. Older mills, which may have lost some of their youthful zip, may be helped with a new prop of lower pitch.

During your first few runs, keep a close watch on the water exhaust. Pump impellers can take a set during the lay-up and no motor will go far without proper cooling. If you routinely replace impellers and fuel pumps every three or four years, you can help keep your engine running sweetly long after your friends have traded off their power plants.

Did you have enough dock lines and sufficient anchor rope last year? Many nationally advertised firms sell the preferred synthetics for about the same price you pay for manila along the waterfront. Guard against chafe and you can get four or five seasons out of the man-made fibers. Strong, elastic nylon is everyone's favorite for anchor and mooring line. Dacron is the sailor's choice for strength with minimum stretch. Polyethylene is almost universal for skiing, while polypropylene is economical and a good work horse. Overhaul the splices and servings. Nylon twine whipping on rope ends makes for a shipshape appearance.

Fenders come in dozens of materials, sizes and shapes. Some boats suffer unnecessary scars because their fenders are too small, too cheap or too few. The round or square inflatables are husky and keep going season after season. "Topside Insurance" is the way experienced boatmen look

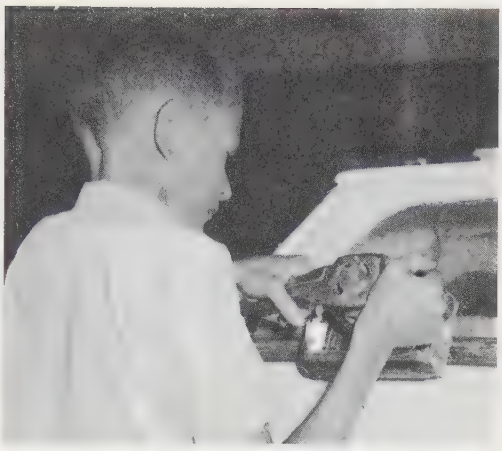
on fenders. And while you are at it make certain you have a neat storage arrangement for fenders and lines. Do not just heave them into the bilge. Hooks, shock cord, and elastic hitches will bring order out of chaos.

The do-it-yourself safety inspection is an important part of spring overhaul. Life jackets and buoyant cushions get shabby or outgrown. Replace them. Pick up a couple of freon cans for the horn. Open the running lights, shine the contacts and look at the globes. If they are blackened, they are about shot. Is the fire extinguisher gauge showing the proper pressure? Do not give it an experimental squirt to make sure or the powder will cause the valve to leak, and the extinguisher will soon be worthless. Are your pumps in good working order? Modern boats do not leak much, if at all, but into every hull some rain or spray must fall. Provide the means for quickly and conveniently getting it back where it belongs.

Your dealer will have scratch remover and windshield cleaners that will bring the plastic backup to snuff. It is surprising how inexpensively an upholstery shop can repair a top or seat covering. These little maintenance details do wonders for appearance.

The galley is usually the mate's job, but give a hand with the stove. If the burners spit and hiss after a good cleaning, replace them. Clean the head. If necessary, a rebuilding kit should be used, and will usually make the head work like new. Look sharply at the hoses and through hull fittings. If the valves do not operate easily, use penetrating oil, or remove, clean and grease. If your builder saved some money and left off the seacocks, install them. If you ever lose a hose, your boat can fill in a hurry. Valves for all through-hull openings are important.

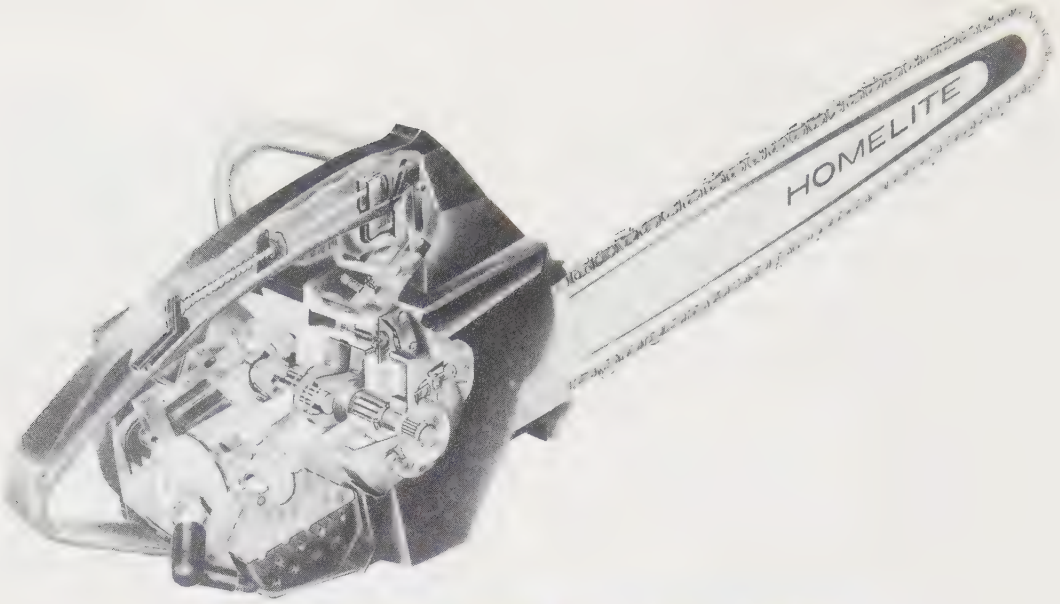
See also: BATTERIES; BOAT ENGINE; BOATING; OUTBOARD MOTORS; STORAGE, BOAT; TRAILERS, BOAT.



▲ *Power sander will make the surface preparation go much faster and easier.*

▲ *Apply scratch remover to put a plastic windshield back into good shape.*

▼ *Thorough surface preparation and a dust-free work area are necessary for a top-notch varnish job.*



Repairing and Maintaining Your Chain Saw

Knowing the basic workings and trouble spots in your saw will save you money in repairs and increase its operating life

THE CHAIN SAW is one of the most efficient and easy to use implements for both commercial lumbermen and backyard gardeners. But it is difficult to expect your chain saw to do a consistently efficient job if it is not maintained and adjusted periodically, and if small repairs become necessary, you should understand how to make them yourself. These ideas will help save your repair money and eliminate those wasted days when you could have been getting that work done.

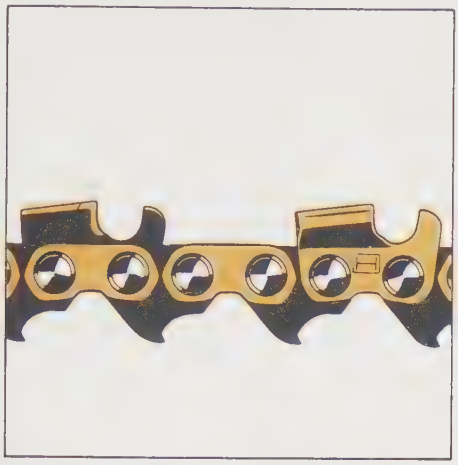
The chain itself is the most important part of the saw but it is also the piece most prone to wear. For maximum cutting speed and optimum life of the chain and all saw parts, always keep the chain in such good condition that bearing down hard to make the saw cut is unnecessary. When the sawdust turns from chips into a fine powder and you find yourself pressing the saw hard against the work, stop immediately and file the chain.

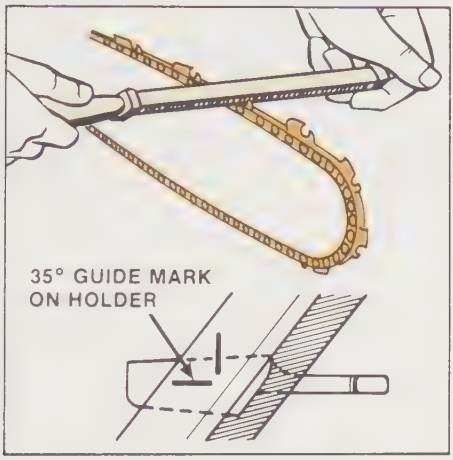
Uniformity and accuracy are necessary for success in filing saw chain. These are easiest to obtain with the aid of a file holder which has the required 35-degree top filing angles marked on it, and also helps you to hold the file at the correct height to produce the required side plate angles and beveled cutting edge.

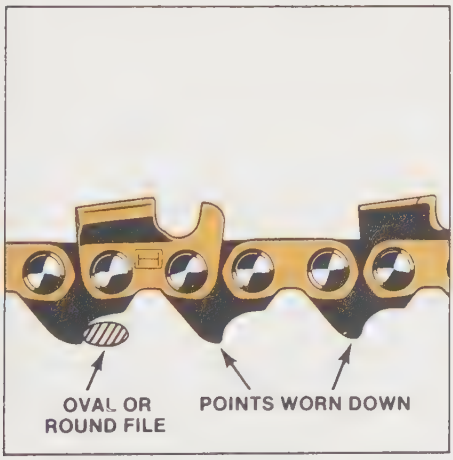
All you have to do is maintain the correct filing angle, height and pressure against the tooth.

For a ¼-inch pitch chain, a $\frac{5}{32}$-inch diameter "fast-cut" round file and holder is required. When about half the original tooth steel has been filed away, you should switch to a ⅛-inch diameter file. The reason for switching to the smaller diameter file on a "short-filed" tooth is the slight taper of the tooth's top plate which reduces the size of the tooth.

manifold gasket: see engine
marbleizing: see painting
marigold: see garden planning
marksmanship: see shooting
marquetry: see inlay woodworking



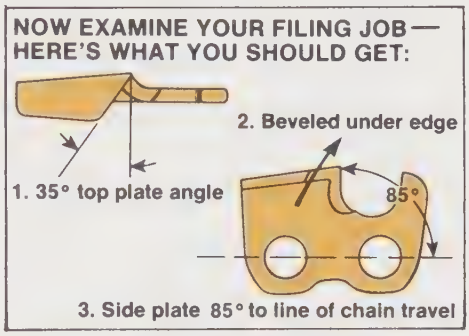


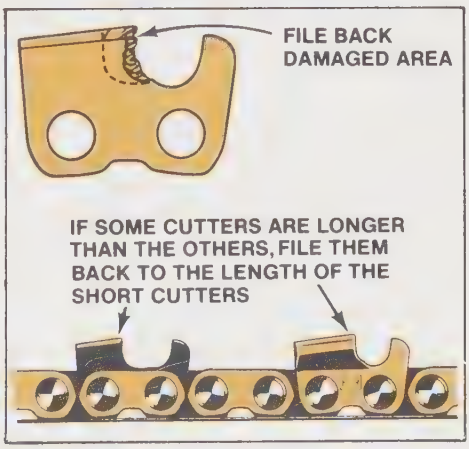


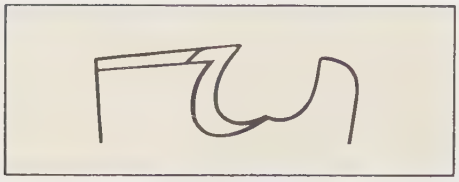
To hold the cutters rock-steady during filing, a chain filing vise is preferable, but if none is available, a satisfactory job can be done on the bar if you increase the tension enough so the chain does not wobble, and do all of the filing at the midpoint of the bar. It will help to wear gloves for protection. Be sure to file all cutters to the same length, and if you replace damaged cutters, file them back to the same length as the rest of the cutters so that each cutter has the same biting chance.

Here are some tips for filing the chain cutters:

1. Hold file against cutter face at a 35-degree angle (marked on file holder).
2. Keep file level—do not let it dip or rock.
3. File in one direction only—towards the front corner of the tooth. Avoid heavy downward filing pressure. The holder will keep ten percent of the

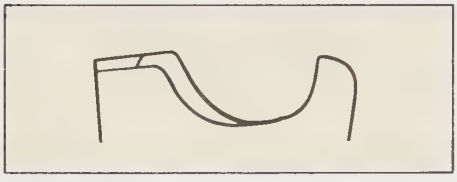

NOW EXAMINE YOUR FILING JOB—
HERE'S WHAT YOU SHOULD GET:
2. Beveled under edge
1. 35° top plate angle
85°
3. Side plate 85° to line of chain travel





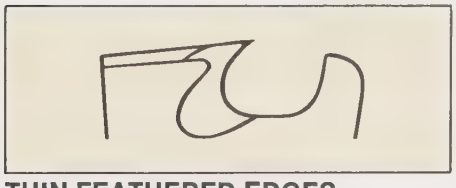
FORWARD HOOK
Chain will grab and jerk, producing rough cutting

Caused by excessive downward filing pressure, or tip of file held too low on tooth.



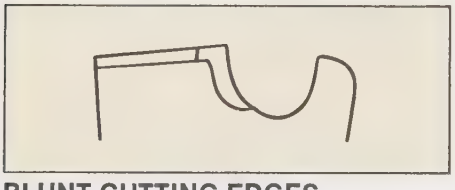
BACK SLOPE
Chain resists entering wood (scrapes instead of cutting wood). Causes excessive heat and wear to bar and chain.

Caused by lowering handle end of file or holding file too high on the tooth.



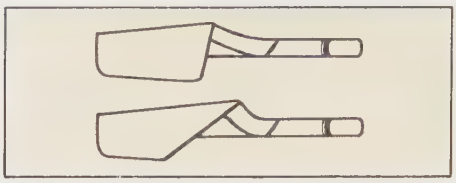
THIN FEATHERED EDGES
When they almost immediately break off, you have a dull chain. Usually found on chain filed with a hook (see "forward hook").

Caused by holding file with handle too low, or pressing down too hard on file.



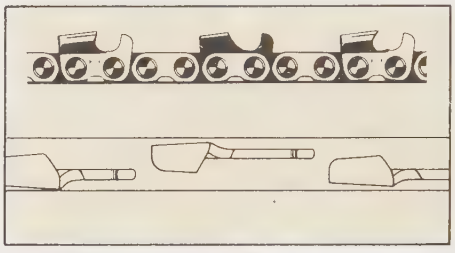
BLUNT CUTTING EDGES
Although edge is durable it won't cut properly; scrapes wood, robs power and produces dust instead of chips.

Caused by holding file too high on face of tooth, or keeping file handle too high.



IMPROPER TOP PLATE ANGLES
Blunt chain requires too much feed pressure. This top plate angle causes chain to bind, produces a rough cut, robs power from saw, and increases bar groove wear.

Caused by holding file at wrong angle or letting it drift or rock during the stroke.



CUTTERS FILED AT NON-MATCHING ANGLES
Chain will not cut at its best. May cut off line or "run" to one side, drag may slow down motor.

Caused by letting pressure and filing angle vary from tooth to tooth or one side filed with different angles and lengths than the other.

file above the top plate, automatically producing a beveled hollow-ground under edge.

4. Put a few firm strokes on every tooth, filing all cutters on one side of the chain, then all cutters on the other side. Rotate file in holder occasionally.
5. A sharp edge will not reflect light. Examine the edge to see if the dulled area has been removed.

Corrective filing involves the proper functioning of chain drive tangs. They must have sharp points to clean sawdust from the bar groove and the bar groove must be

deep enough for the tangs to clear bottom all the way around bar. Every fourth or fifth tang resharpened will do the job as the chain wears.

When the teeth have hit hard objects such as stones, nails or concrete, or cut dirt, sand or mud, the damaged area must be filed away before the tooth will cut or have the proper set. All cutters must be filed equally back to this point, which can be done by hand. It is less expensive and easier to have it done on an electric chain grinder at your dealer or factory service office. This offers an extra advantage since it "trues" the chain to original factory shape.

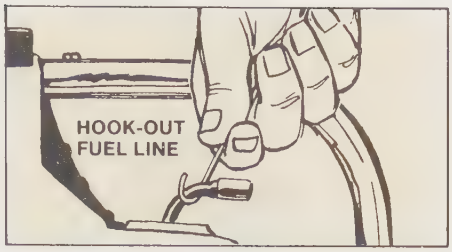
Every second or third time the teeth are sharpened, or if a large amount of steel is removed from the cutters, the depth gauges should be jointed uniformly to a depth of .020 inches.

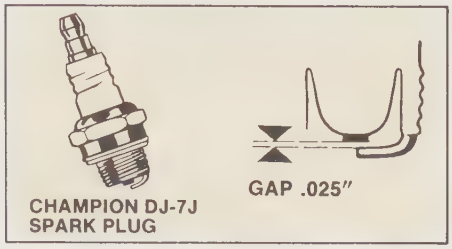
Use a depth gauge tool and a safe-edge (no teeth on edge), flat file. Fit the tool over the chain so that the slotted end of the tool points toward the bar nose and the depth gauge projects up through the slot. File the depth gauge flush with the top of the tool. File all gauges to this height.

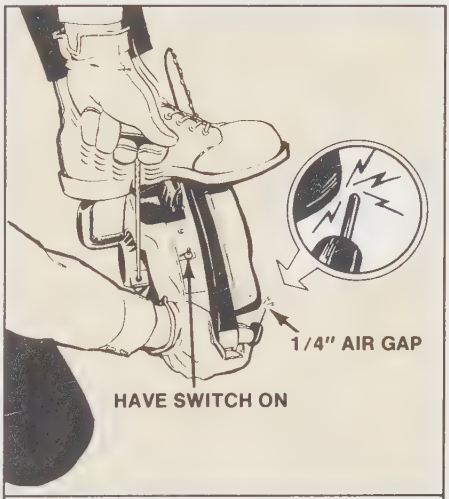
If the gauges are too high, the chain teeth will not get a good bite; if too low, the teeth will take too large a bite, causing the chain to grab and jerk. If some gauges are higher than others, the chain will cut off line, favoring the side having the lowest gauges.

As far as regular maintainance of the engine section of your chain saw is concerned, the only steps to be performed are cleaning of the screen type oil pick-up filter hanging inside the chain oil tank and changing of the sintered bronze fuel pick-up filter in the fuel tank. This should be done once each year or every 50 hours of operation.

For access to the oil or fuel pick-up, unscrew the tank cap. Bend a piece of wire (or straighten a paper clip) to form a hook. Reach inside the tank with the hook. Hook the pick-up line, draw it up carefully out of the filter hole and pull out the filter on the end.



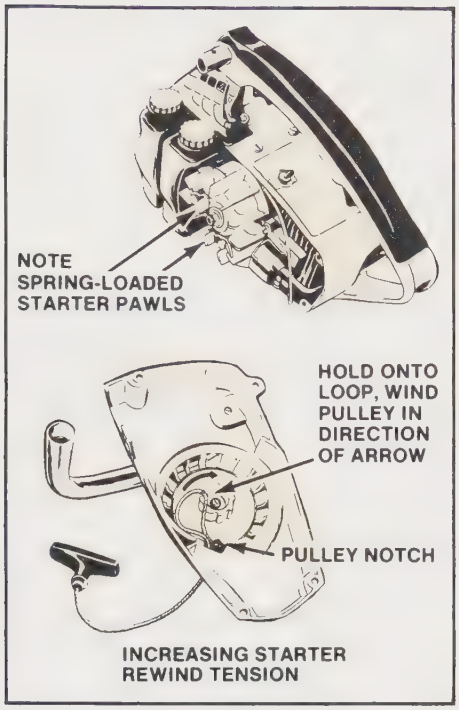




BROAD, BLUE OR WHITE SPARK	Magneto is O.K.
WEAK SPARK	Magneto output may be low, or there may be an insulation leak.
NO SPARK	Have ignition checked by your dealer.

A symptom of fuel starvation (engine lacks power, will falter on application of cutting load) requires a process of check-

RECOIL STARTER REPAIRS

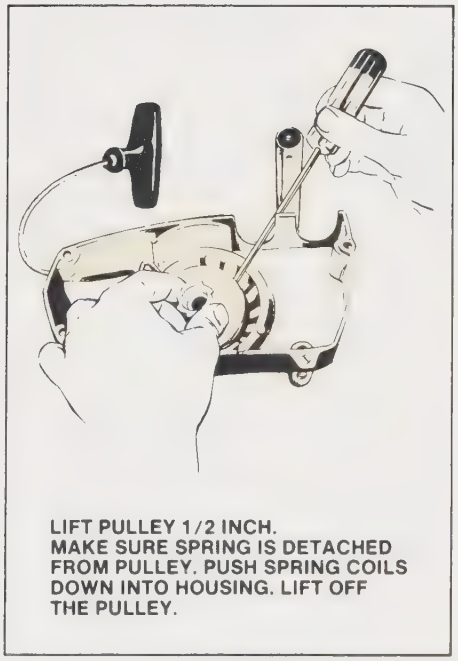


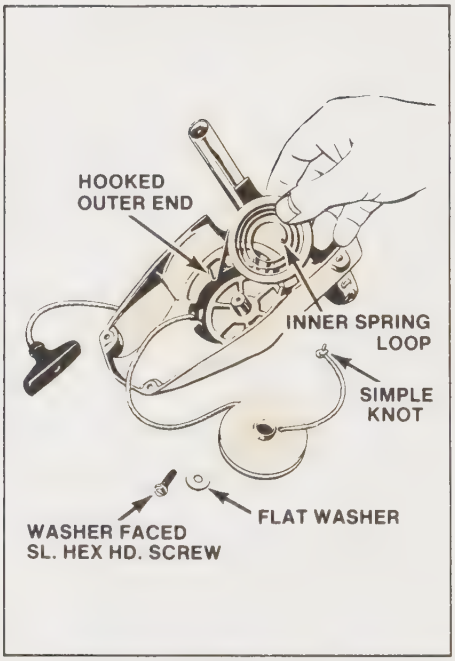
ing to determine the cause. Causes in the order of probability are: dirty fuel filter, leaking or kinked fuel line, clogged "duck-bill" vent valve in fuel tank, dirt or other trouble inside carburetor, and air leaking into the crankcase.

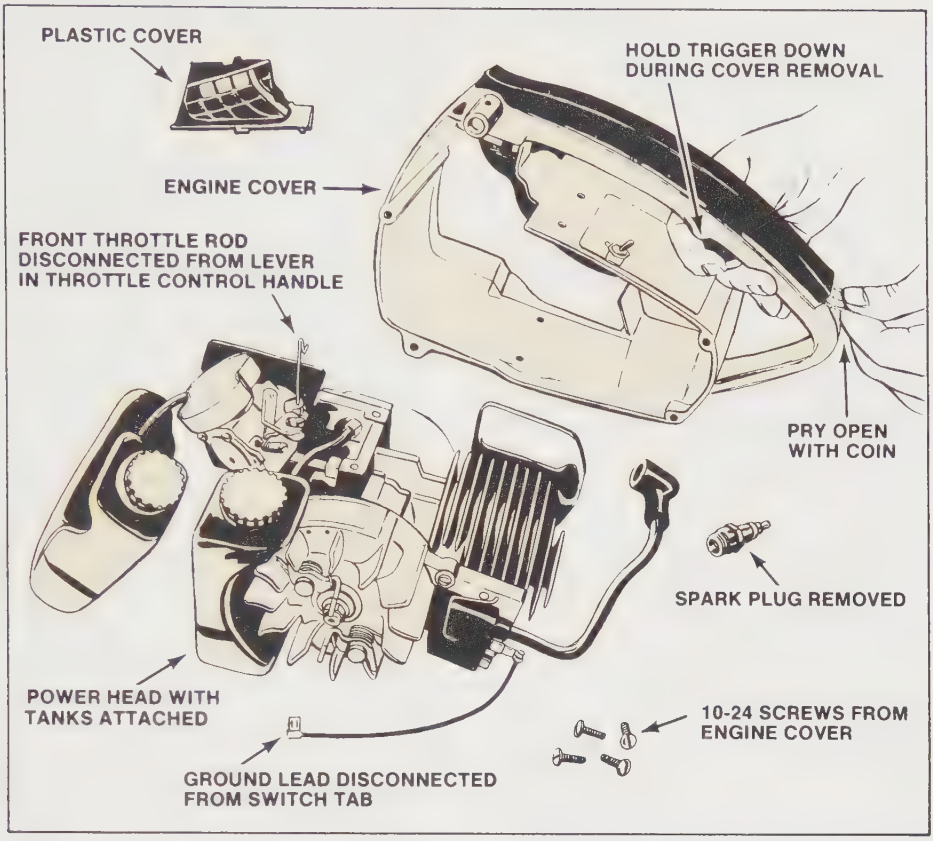
To determine which of these is the cause, begin your checking sequence by changing the sintered bronze filter. If this does not restore power, loosen fuel cap just a little to check vent valve operation. If the saw has more power when cap is loose than when tight, have the "duck-bill" vent valve changed.

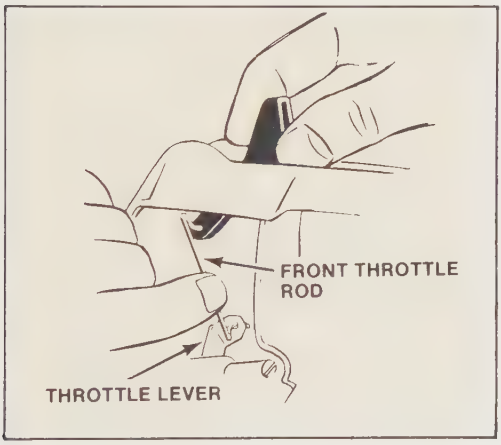
Next, check out the fuel line all the way from the pick-up filter to the carburetor inlet. Replace if cracked, kinked or distorted, or if the ends are split or otherwise loose-fitting. Take the saw to a dealer if starvation symptoms persist after these checks.

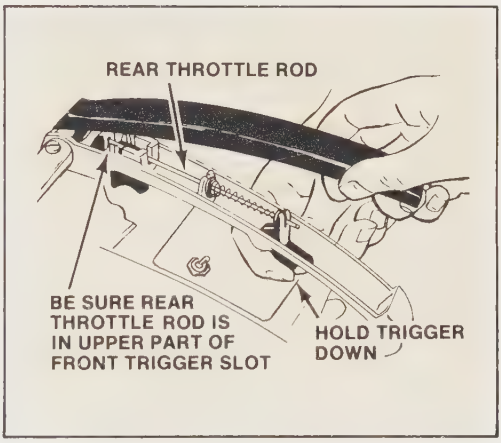
The spark plug is another important point of chain saw maintenance. Always make sure the connector boot is firmly pressed on the plug. Incorrect engine oil,






PLASTIC COVER
HOLD TRIGGER DOWN DURING COVER REMOVAL
ENGINE COVER
FRONT THROTTLE ROD DISCONNECTED FROM LEVER IN THROTTLE CONTROL HANDLE
PRY OPEN WITH COIN
SPARK PLUG REMOVED
POWER HEAD WITH TANKS ATTACHED
10-24 SCREWS FROM ENGINE COVER
GROUND LEAD DISCONNECTED FROM SWITCH TAB





incorrect fuel mixing, wrong carburetor mixture adjustment, or excessive flooding of the engine during starting, will cause deposits to form on the plug electrodes. After many hours of use, the plug may also require cleaning and regapping of the electrodes. For most saws, the firing gap is .025 inches. Always clean the insulator and the electrodes before setting the gap. Always bend the side electrode toward the center

one when setting the gap. Rounded or pitted electrodes should be filed smooth and square to induce the spark to jump the gap.

While you have the plug out, test the ignition system to see whether there is a good spark being generated by the magneto. This is done by using a ¼-inch diameter metal rod (a screw works nicely), and inserting it into the spark plug boot to contact the spring connector inside. Holding the spark plug boot well back on the insulation, position the rod so there will be an air gap of ¼-inch between the rod and a metal edge of the muffler. With switch turned to "on" crank the engine briskly and observe whether a spark jumps the gap. In bright sunlight you can hear the snap of a strong spark even though you may not be able to see it.

Another important point of maintenance is the cylinder fin area. Cooling air drawn in by the fan flows between the cylinder fins and is discharged around the muffler. In order for the engine heat to be transferred from the fins to the air, the fins must be clean and the air passage open. Do not let sawdust, leaves and dirt build up in this area. If the engine appears heavily clogged, remove the engine cover assembly for complete cleaning.

Occasionally, the muffler should be removed from the engine and the cylinder fins cleaned down to bare metal. At the same time, deposits should be scraped from all surfaces of the muffler, and the scrapings removed before muffler is reassembled. You should keep watch on the small louvered discharge holes in the muffler, and pick them clean whenever deposits are noted.

Also, the power head and tanks should be removed for cleaning and inspection every 50 operating hours. Under certain conditions, as when oil or fuel spilled down inside the engine cover has resulted in a grimy accumulation, the power head should be removed for cleaning. To accomplish this, remove the guide bar and chain. Remove the screw through the top of the handlebar and the four screws through the starter/fan housing to the engine housing. Lift the starter/fan housing and the handlebar off the engine. Remove the plastic air filter cover. Then disconnect the switch lead at one end, and take out the spark plug.

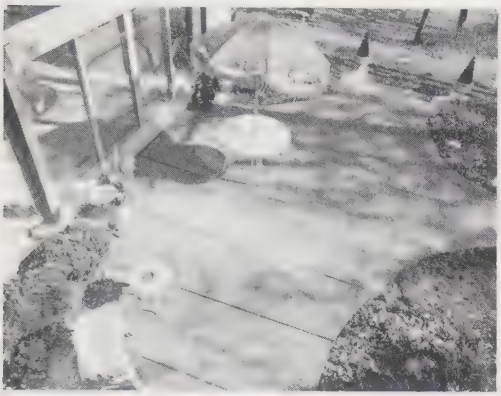
Using a coin or screwdriver tip, pry between the handle and the black handle cover at the rear to produce enough of a bow for the locking tab to clear the casting. Then lift the cover at the front. Immediately place your hand on the throttle rod and spring so they do not fly out.

Remove the rod and spring and the rear trigger. Grasp the front throttle lever and pull it out of its cradle in order to unhook it from the front throttle rod (which is connected to the carburetor throttle lever on the other end). Lift out the front trigger. Pull the power head out of the engine cover.

To install a new power head, be sure to push the spark plug wire into approximate position as you place the head back into the engine cover. If the front throttle rod came off the carburetor throttle lever, hook it back on. Push power head into place in cover. Connect ground lead to switch tab and install spark plug and connect the plug wire to it.

Put front trigger back in handle. Connect the front throttle lever to the throttle rod and put it in its cradle in the handle. Put the rear trigger into the cradled position and assemble the spring on the throttle rod and position them. Pick up the black handle cover. Then, rehook it in place at the front end of the handle and press down at the rear until the rear tab locks the cover in place. Try out both triggers—if they do not work the throttle propertly, something may have slipped out of place. Check placement of parts and try again. M.E.F.

See also: SHARPENING; TOOLS.



Concrete Improvements Around Your Home

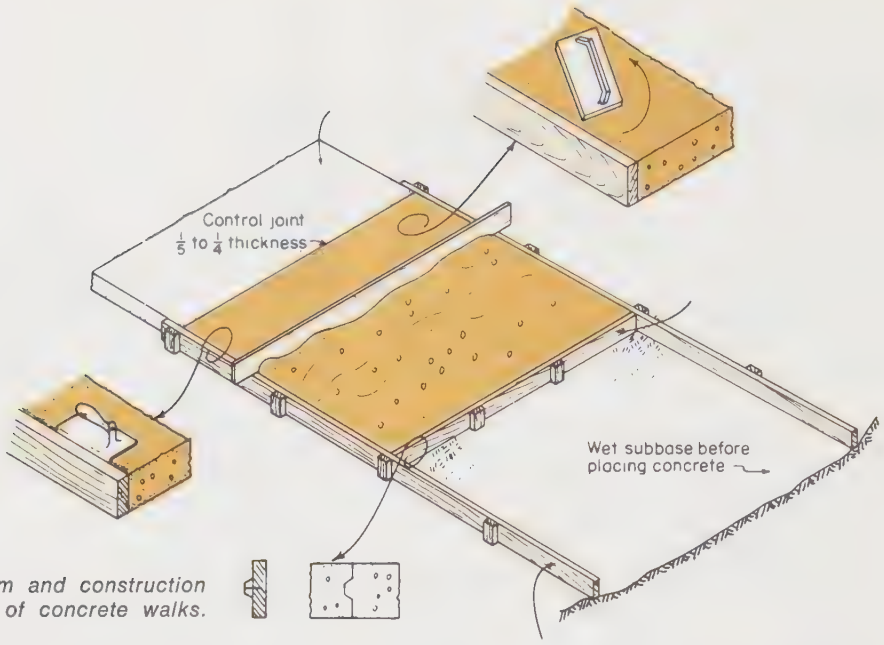
The versatility and weathering properties of concrete make it the ideal material for additions and improvements from driveway to patio

YOU CAN MAKE a dramatic change in the appearance of your home with one versatile and easily manipulated material: Concrete. Virtually every side of your home, from sidewalks and driveways in the front to patios and garden walls in the rear, can be improved by knowing how to work with concrete.

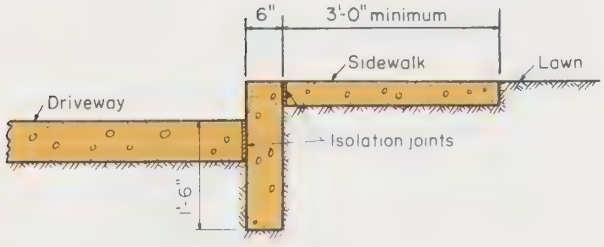
Some advantages of concrete are its superb weathering properties and the ease with which it can be maintained, so this makes it an ideal material for constructing a front sidewalk. Concrete walks provide easy access to the house in all weather and give the children a hard-surfaced play area. Not only are they serviceable in all types of weather, but concrete walks, whether plain, patterned or colored, lead a visitor's eye to the center of interest—your home.

The construction of a high-quality, durable concrete walk is surprisingly simple. You can place sections of the walk in easy stages at your convenience, but if ready-mixed concrete is ordered, you will want

masonry drills: see hand tools
masonry repair: see concrete
medicine for campers: see first aid
metal cutting: see saber saw
meter, exposure: see photography



Form and construction detail of concrete walks.



Curb and sidewalk detail.

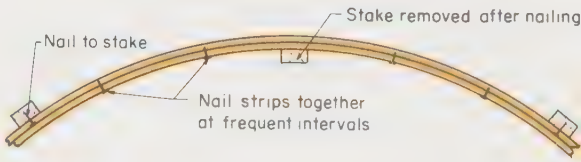
to do the entire job at one time. This may also mean getting extra help.

Careful preparation of the area is most important if the finished job is to have the high quality you desire. The main walk should be at least three feet wide, and service walks a minimum of two feet wide.

All sod and debris must be removed to the depth of the walk. A subbase of crushed stone is used where the soil is spongy or the area is low and wet. Form boards (2x4-inch) are used and held in place by stakes. The cross-slope should be ⅛-inch per foot to drain away from the house or buildings.

For laying out pleasing curves in walks, a flexible garden hose can be used to mark off the curvature. Curved forms are easily made with two thin strips of plywood or hardboard. Bend the first strip to the proper radius by setting outside and inside stakes. Nail through the strip to the outside stakes, then place the second strip inside the first and nail the two together. Remove the inside stake and the form will hold its curved shape.

In making the walk, use quality concrete —one part portland cement, two parts sand and two and a quarter parts gravel with no more than six gallons of water per bag of cement. For a four-inch thick sidewalk, one cubic yard of concrete will be enough for 27 linear feet of a walk, three feet wide. Use asphalt impregnated joint material where the slab abuts foundations, curbs or steps. Control joints, which are weakened planes to control cracking, are cut with a groover four to five feet apart to a depth



Usual method of forming curved sidewalk is shown.

of one-fifth to one-fourth the slab thickness.

If you wish to stop at any point, simply place a wood bulkhead at the point where you left off. Make the bulkhead from a 2x4-inch piece cut to the inside dimension of the walk forms. Then nail a beveled 1x2-inch strip to the 2x4 bulkhead so that future sidewalk slabs will always remain level with the previously cast slabs.

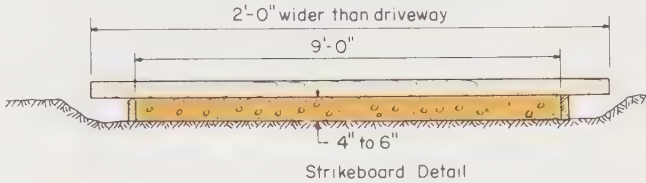
Place the concrete into forms after wetting the subbase. Screed the surface until it is even with the top of the forms and finish off with a wood or light metal float to give a gritty non-slip surface. Use an edger on all open edges to give a long-wearing and weatherable edge. If you wish to pattern the walk, be sure to do so before the concrete hardens.

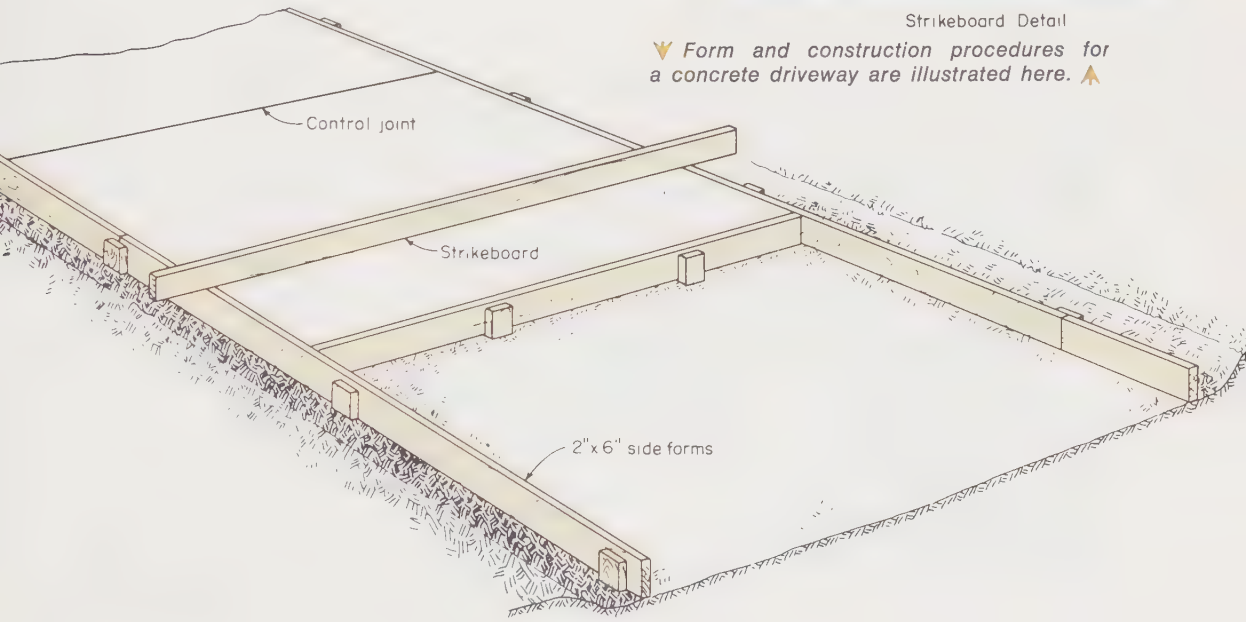
Cover the walk with a sheet of plastic, sand, burlap, or other material and dampcure it. This will give your walk sufficient protection until it has time to harden. Once hard, it will last for years and endure almost any possible extremes in the weather.

A durable material is also very important for driveways. In constructing a driveway out of concrete, you will find that the most attractive approach is one which will show off the home to the best advantage and provide year-round access under all conditions. The now easy availability of ready-mixed concrete makes the installation of a drive easier than ever before. Order ready-mixed concrete containing not more than six gallons of water per bag of cement and figure on six bags of cement per cubic yard and six percent entrained air.

Driveways designed for single cars should be eight to ten feet wide to allow passengers to step from the car onto the driveway. Where only passenger car traffic is expected, plan a concrete driveway four inches thick. When heavier vehicles such as trucks or tractors use the drive, it should be six inches thick.

The concrete is placed on firm earth or a gravel subbase using 2x4 or 2x6-inch forms. The cross slope or pitch should be





Form and construction procedures for a concrete driveway are illustrated here.

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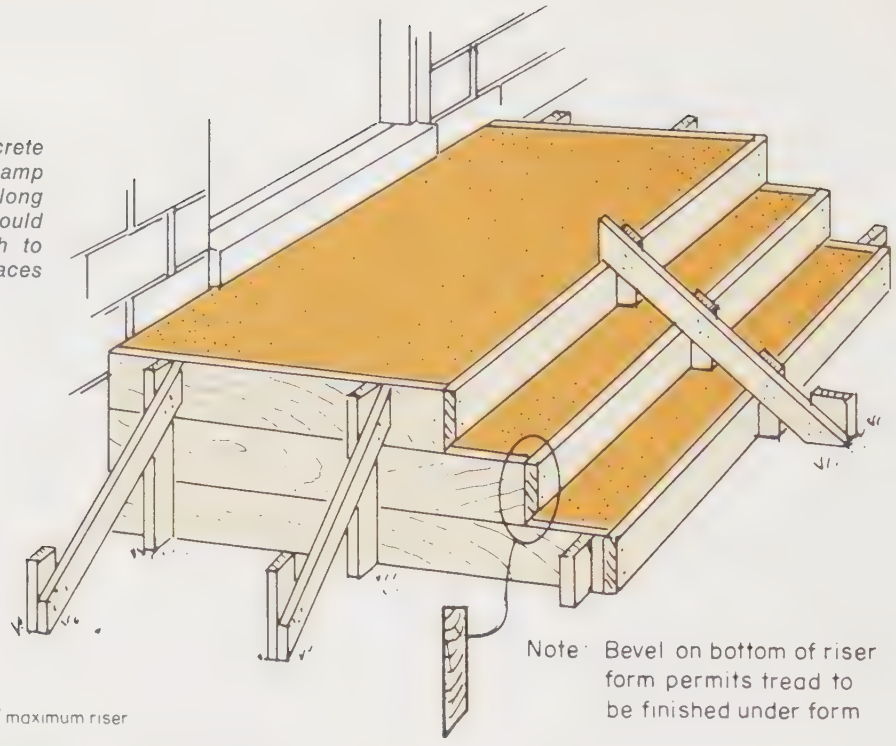
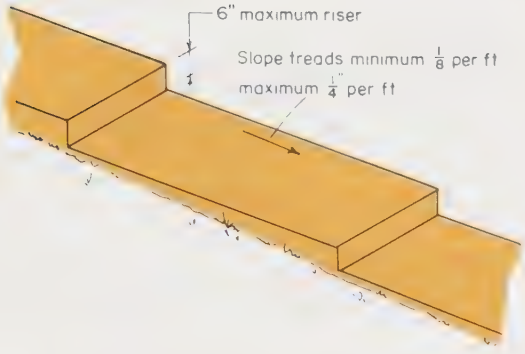
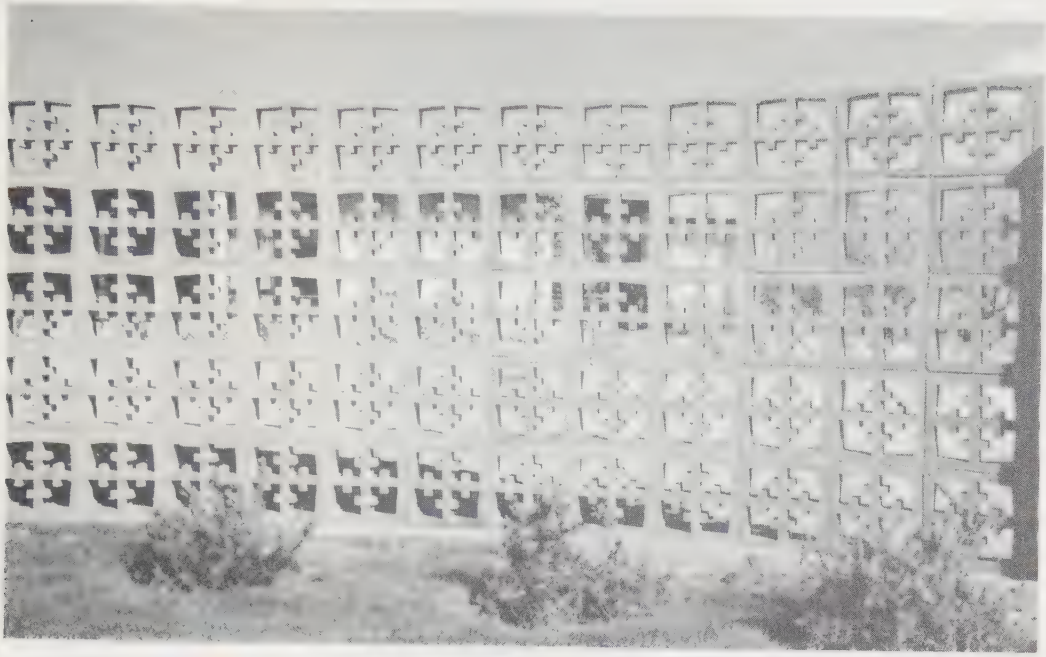
Form for concrete steps. A stepped ramp is often used on a long slope. Ramps should have a tread length to provide two easy paces between the risers.



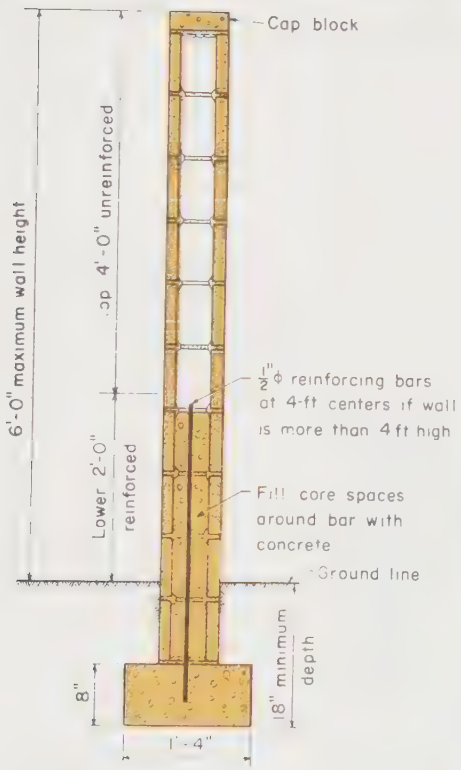


A simple form for constructing stepped ramps.

Concrete steps and patio make a lovely setting for this attractive home.

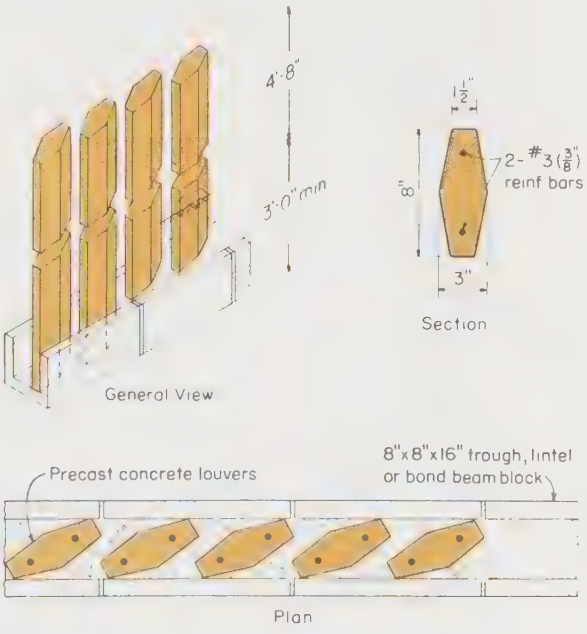


▲ *Lacy, intricate patterns in screen wall add variety and beauty to your landscaping. Walls can be painted with cement paint, or left unpainted.*

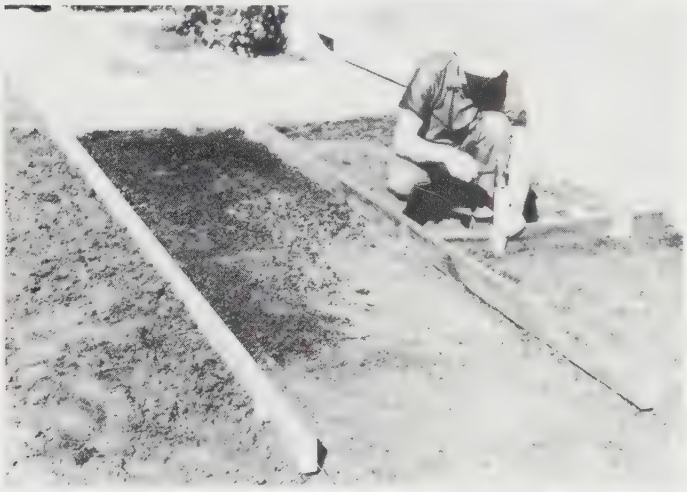

Cap block
6'-0" maximum wall height
Top 4'-0" unreinforced
Lower 2'-0" reinforced
½" ϕ reinforcing bars at 4-ft centers if wall is more than 4 ft high
Fill core spaces around bar with concrete
Ground line
8"
18" minimum depth
1'-4"

▲ *Easy method for construction of a solid masonry wall.*

▼ *Attractive louvered walls can be built using precast concrete sections.*



Start building a patio by removing sod and debris from area you wish to cover with concrete.

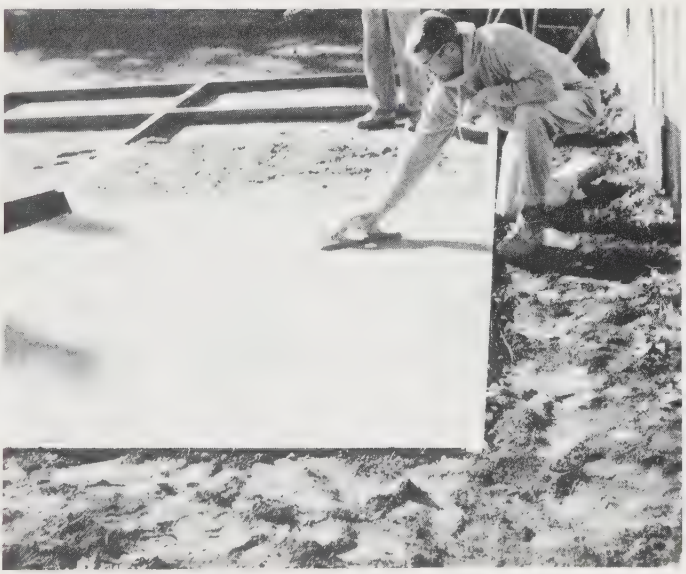


Set forms in prepared area. If desired, forms can be left in place, as in this patio, after the concrete has set. If you leave the forms in, use redwood or preservative-treated wood.

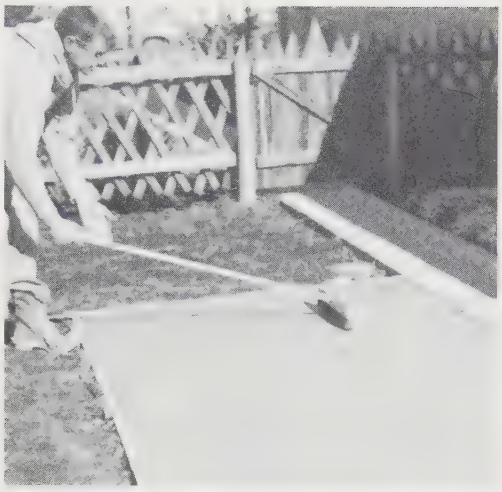
Fill completed forms with a two-inch layer of sand.

➢ *If you are leaving the form in place, cover the top with masking tape to protect the surface from wet concrete.*

➢ *After the concrete is poured and spread, use a 2 x 4 to strike-off the surface, bringing it flush with the top of the form.*



➢ *After strike-off, float surface with a wooden float.*



Broom the surface to give it an anti-slip texture as well as an attractive design.

Cover finished job with plastic film while it moist-cures for at least five days.

a minimum of ⅛-inch for each foot of width. To level the concrete, use a long 2x4-inch strike-off board riding on each side form. Control joints, cut to a depth of one-fifth to one-fourth the thickness of the slab every ten to fifteen feet, will control cracking of the concrete. Moist-cure the concrete for at least five days.

Attractive patterns can be built right into the driveway surface. Light brooming makes a skid-resistant surface and, with a little imagination, you can make your own attractive and functional designs.

Because concrete does not rot and can be kept clean with simple sweeping or hosing down, it is the ideal material for building steps. They make a home approach much safer and more attractive, and when properly built, they are non-slip in wet weather and require no painting.

The steps should be at least as wide as the sidewalk, and all risers should be exactly the same height. A landing is only needed if there are flights more than five steps high. For safety and convenience, the thread should be at least 11 inches and all treads should be the same width. The rise for each step should be not more than 7½ inches with a ⅛-inch pitch allowance on each tread for drainage.

An economical way to keep steps from sinking is to dig 2-, 6-, or 8-inch diameter postholes beneath the bottom tread. The holes extend below the frost line and are filled with concrete. The top step or platform is tied to the existing wall with two or more metal anchors. Forms should be placed, braced, then oiled for easy removal. Well-tamped soil or granular fill may be used inside the forms to reduce the amount of concrete needed for the steps.

Place the mix of quality concrete into the post holes and the forms, starting at the bottom. Spade the concrete thoroughly around the form edges. Tap the forms lightly to release air bubbles, and screed off the concrete at tread level. Finish the treads with a float and then broom to create a non-skid surface. Moist-cure for at least five days, remove the forms and wire, and brush the steps to clean them.

High quality precast concrete steps are also available from many manufacturers. These steel-reinforced units may be obtained in several types. They are quickly installed and usually have built-in lugs to hold railings and grille work.

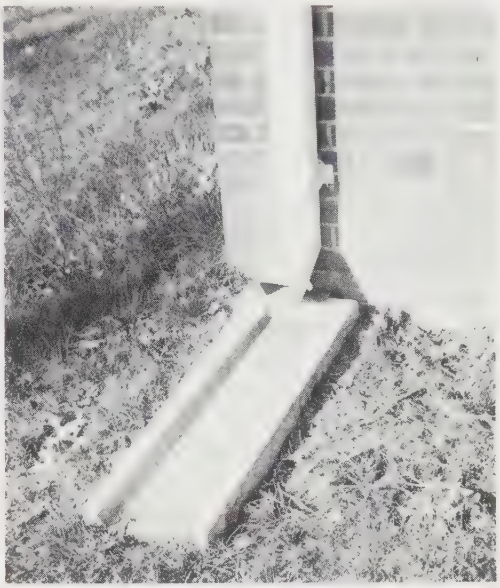
Outdoor living areas are also greatly en-

hanced by other concrete products. Attractive garden and screen walls which are well engineered and tastefully designed in concrete can add a new dimension to your backyard. From the simple 8x8x16-inch concrete block to the newest screen wall unit and grille block, concrete gives the beauty, the appeal, and the pleasing backdrop for a beautiful garden setting. Also, because concrete will not peel, warp, rot or decay in adverse weather, it will maintain its beauty for years.

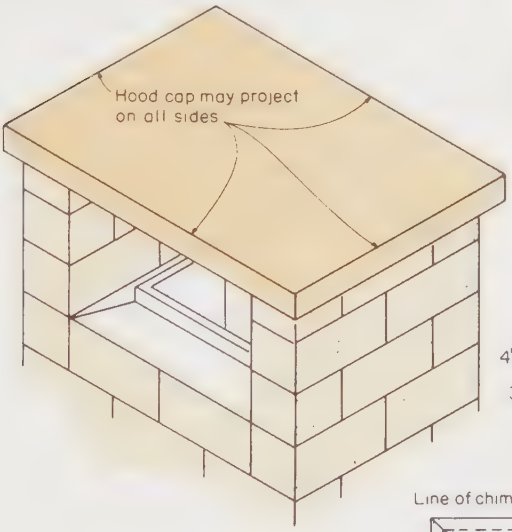
Garden walls furnish privacy for your outdoor living area and around swimming pools. Solid walls of block can protect your area from chilling winds, yet with very little design change, block can be placed so air circulates freely through the wall.

Both solid and open-type garden walls are used as needs dictate. The many textures and patterns available in concrete help dramatize your landscaping ideas. Patterns of squares, rectangles, and strong diagonal lines add a feeling of movement to ordinary garden walls. Lacy, intricate patterns of screen block walls add beauty and an air of grandeur.

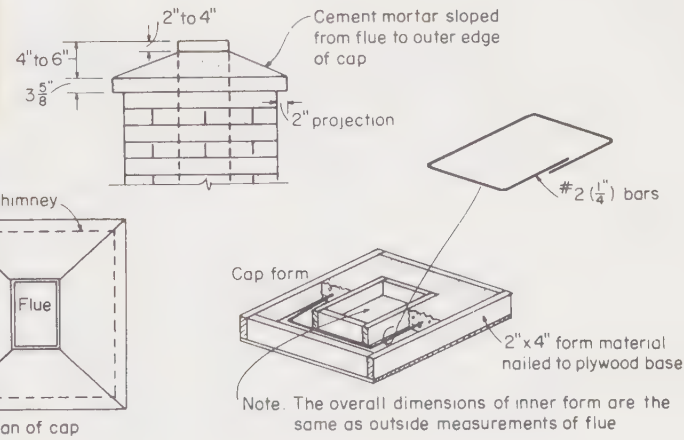
For a rugged appearance, extruded mortar or offset block in the garden wall lends a feeling of security. Split block and textured block capture shadows and highlights creating ever-changing shadow patterns and designs.



Concrete splash block carries downspout water away from wall.



Protect masonry with chimney cap. It not only improves the appearance but keeps out rain and snow.


2" to 4"
Cement mortar sloped from flue to outer edge of cap
4" to 6"
3 5/8"
2" projection
Line of chimney
Flue
Plan of cap
#2 (1/4") bars
Cap form
2"x4" form material nailed to plywood base
Note. The overall dimensions of inner form are the same as outside measurements of flue

Garden walls need good foundations to keep them attractive for years of service. Lay out the wall in the desired line and dig a trench slightly wider than twice the thickness of the proposed wall. The trench should be a minimum of 18 inches deep or below the frost line in colder areas. Make the footing twice the width of the wall, and the same depth as the wall width. Thus for an 8-inch block wall, the concrete footing should be 16 inches wide and 8 inches thick. Then follow the same procedures mentioned earlier for laying block.

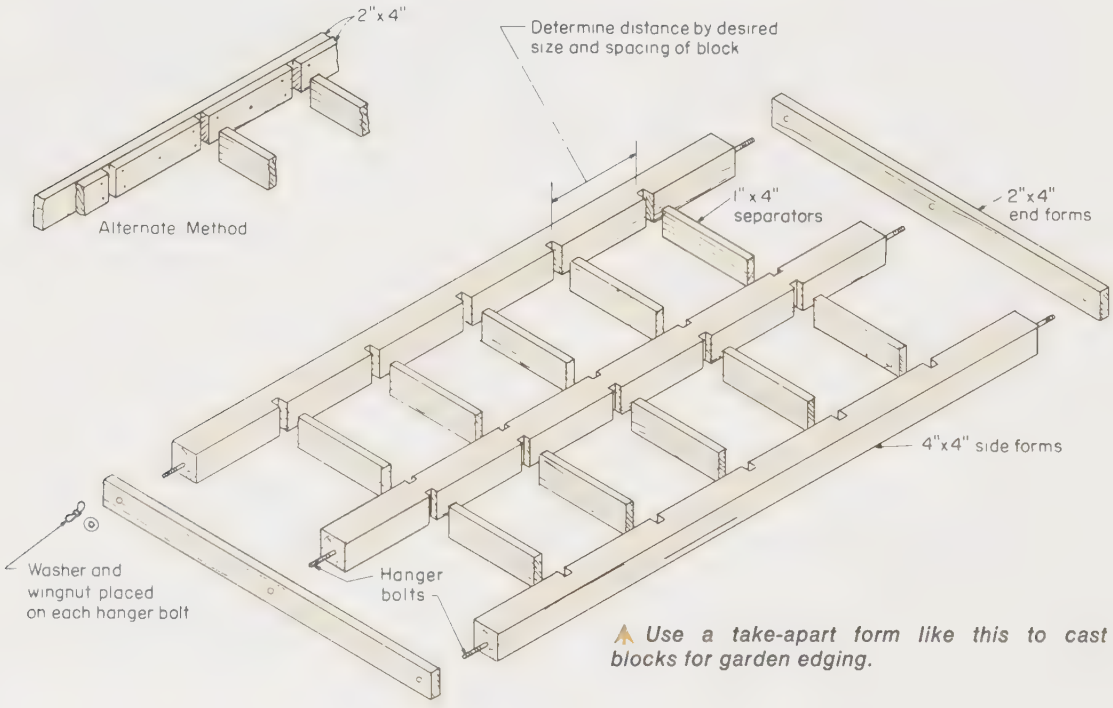
There is an old saying that, "Where you have the walls of a house, you have the start of a patio." This means you already have exciting possibilities for a garden terrace or an outdoor living room—and all your visions can be realized with concrete.

To build a cast-in-place patio, mark off the area and remove sod and soil to the depth desired. Most patios are formed with 2x4-inch wood forms. For circular borders, drive stakes on desired arcs and place two thin strips of wood around the stakes. By nailing the strips together, an arc is formed and can be held in place by outside stakes.

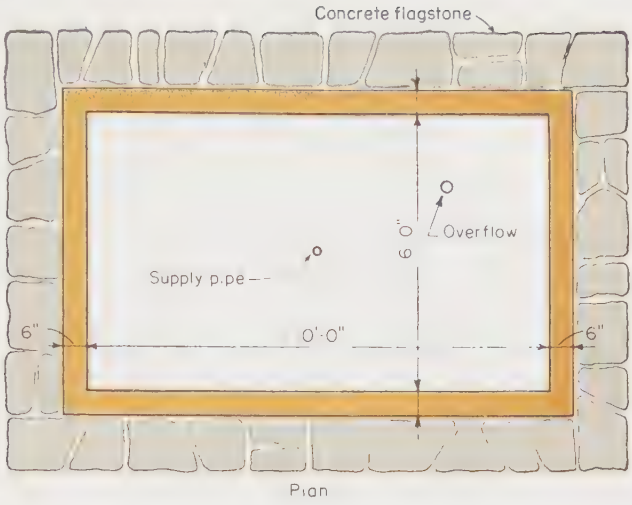
For dividers to be left in the concrete, use redwood or treated lumber placed to give the desired patterns. Where this is done, you will want to protect dividers by covering the top edge with masking tape before the concrete is placed. Set the forms with a slight pitch to keep water away from the house and to aid water run-off when hosing down.

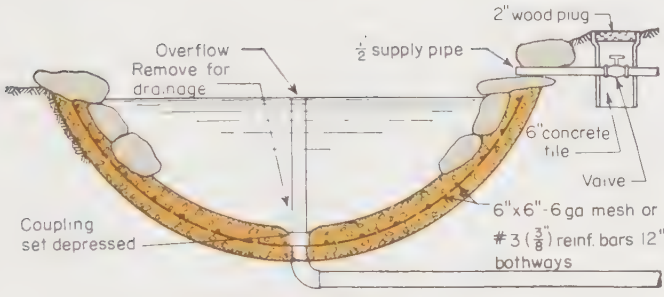
One cubic yard of concrete will place 81 square feet of 4-inch thick patio. To allow for waste and irregularities in excavation, order 5 to 10 percent more concrete than actually calculated. Order a mix of six bags of cement per cubic yard with not more than six gallons total water. Specify six per cent air entrainment.

Be certain all forming is ready before concrete is delivered. Check forms and have finishing tools and enough labor on hand. If you have never finished concrete, consider hiring a concrete finisher. Spade the concrete well into the corners of the



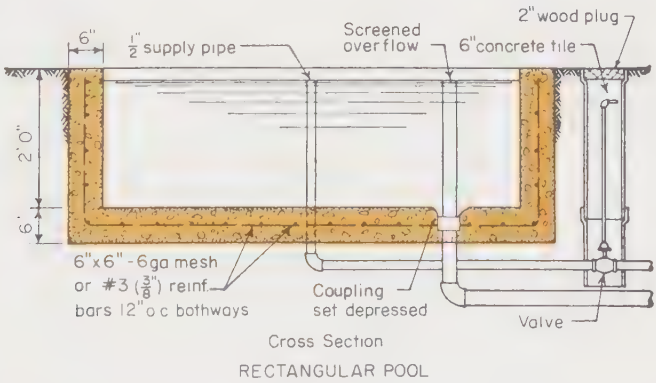
Use a take-apart form like this to cast blocks for garden edging.





You can put a pool in your landscape scheme.

Shown are cross sections of designs for a bowl-shaped pool and rectangular pool.

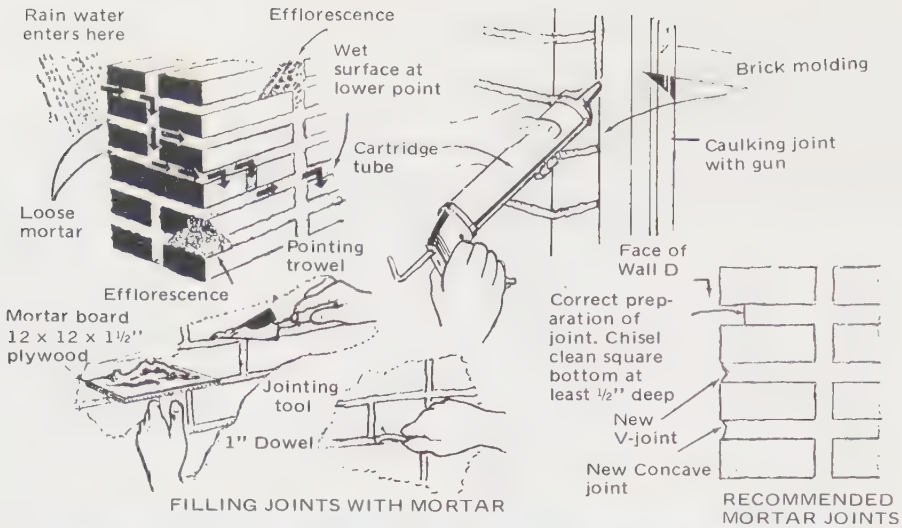


forms. Overfill the forms slightly, then screed with a straightedge.

Check the concrete frequently to determine when it is ready for finishing. Wood floating will give the concrete a rough texture; steel troweling is used for a dense smooth surface.

Moist-cure at least five days. M.E.F.

See also; BRICKWORK; CONCRETE; CONCRETE BLOCKS; PATIOS.



FILLING JOINTS WITH MORTAR

RECOMMENDED MORTAR JOINTS

Stopping Leaks in Masonry Walls

How to remove efflorescence and halt water seepage; the techniques of tuckpointing, caulking windows and patching stucco

EFFLORESCENCE AND DAMP SPOTS on the walls of your home are the symptoms of water penetration that should be halted before heavy leakage causes extensive damage.

The wise home owner checks his walls for small leaks, and loose spots and completes repair work before old man winter has the chance to deepen the destruction with freezing rain and mortar-cracking ice.

Efflorescence, the whitish growth of mineral crystals, so often seen on the surface and in the pores of masonry, is an annoying eyesore that is easily removed. However, it may also be an indication of more serious trouble elsewhere in the structure.

In all brick and concrete walls, water slowly percolates through the pores. No building material is completely free from all water soluble salts, and as the water evaporates from the surface, particularly after long rainy spells, the salts are seen in concentrated spots. If the spotting is greater in a certain area of a wall, it indicates a heavier evaporation at that place, and may point to leakage.

Begin by taking a good look at your home in general. Check the inside walls for damp spots in the plaster, wallpaper stains, and peeling paint. Look at gutters, rain spouts, and flashings for leaks that may be channeling a flow of water toward a troublesome spot. In the basement, be sure that the inside walls have free air flow for good evaporation. Boxes and cabinets should never be pushed up tight against the walls. Allow at least four inches of free circulation space.

Removing efflorescence. Usually efflorescence does not appear during hot summer months, since the water evaporates so rapidly that only small amounts of salt are brought to the surface of the masonry. Also, it tends to diminish as a building ages. You can remove light flaky deposits by scrubbing the wall with a stiff brush and water. Heavier hard whitish deposits are generally composed of calcium carbonate. Cement contains calcium hydroxide, a soluble material, which when brought to the surface, combines with carbon dioxide in the air, to form calcium carbonate, a hard, very slightly soluble salt.

To remove it, obtain some hydrochloric acid (commonly called muriatic acid) from a paint supply store and dilute it with 5 to 10 parts of water. Caution: Always pour the acid slowly into the water, never the reverse, to avoid spattering, and wear goggles and rubber gloves.

Wet the wall first, filling the pores with water to prevent the acid from biting in too deeply. Try a small spot first and scrub with a fiber brush. The acid would, of course, attack a metal brush.

Start with a weak (1:10) acid solution, since it is less likely to cause stain, and to penetrate the masonry. Add more acid if you need a stronger solution to remove the efforescence. Avoid mortar joints, and concrete masonry, since the acid will soften cement. Immediately after the acid scrub, wash the wall thoroughly with water and follow up with a wash of 1 pint of ammonia to 2 gallons of water to remove all traces of acid.

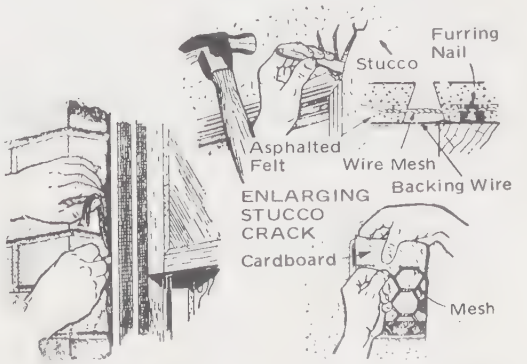
Dampness and leaking walls. Dampness in basement rooms may be caused by condensation, as well as leakage. To determine whether you have a seepage condition, or whether the moisture is condensing from the air inside, tape a piece of flat bright tin, about 6 inches square, in contact with a damp part of the wall. Allow it to remain undisturbed for about an hour. If the visible surface remains dry, it indicates that airborne moisture is not the problem, and that there is seepage. Otherwise, if the visible surface shows moisture, it shows that condensation is a cause, and of course, that seepage may also be present.

The most common cause of seepage and leaking walls is loose or poorly applied mortar on the outside. In some places, walls are subjected to unusual weather, vibration, high winds, or extremes of temperature which cause more rapid loosening of the mortar. The dampness on the inside may appear at a much lower level than the joint on the outside where the water actually enters. An extreme case occurs when a neglected leak, over a long period of time, has loosened joints inside the wall, to permit a flow of water to enter. Bricks may be loose, and spots of efflorescence develop both below and above the place where the leakage is heaviest.

Dampness from condensation is often heaviest during winter months, since it is likely that basement windows will be closed and ventilation at a minimum. Winter air holds less moisture, but furnace humidifiers, hot water vapor from the laundry, and cooking will build up humidity in a well insulated house. Remedies are to maintain good ventilation so that the walls will be warm, and hence not cool enough to condense water; and also to use de-humidifiers. These units are commercially available and incorporate a blower and a cooling coil that condenses moisture. They will collect as much as a gallon of water a day in a small basement.

If pipes in your basement are condensing water, you can stop the sweating and corrosion by painting with new plastic coatings. These paints can be used on any clean surface, but require a primer coat if used on severely rusted or pitted pipes.

Drilling "weep holes." Damp spots on plaster behind brick veneered walls, are likely to be found near the floor. If the trouble is due to condensation on the inner side of the brick, it cannot be cured by sealing defective mortar joints, although this should be done in any case. Provide a means for the water vapor to escape from behind the brick by drilling ½-inch holes



in the mortar near the bottom, with a star drill and hammer, or with a carbide bit in a power drill. Slant the holes upward toward the inside of the building, and space them about 16 inches apart.

Cleaning joints. If you are repairing brick walls just for the sake of general maintenance, remove only the joints that are noticeably loose or beginning to crumble. On the other hand, if your wall is in such condition that you have seen water entering at a certain place, chisel out every joint in the vicinity. If bricks are broken, obtain new ones of the same type.

Clean out the joints with a small chisel, a pick, or use a star drill and hammer. Be sure to protect your eyes from flying chips. Cut in at least ½-inch, making square bottoms to provide enough depth and surface for the mortar to grip. Clean and wash out the openings with water and a small wire brush, allowing them to dry partially before pointing with new mortar.

Mixing mortar. Begin by improvising a mixing box, by lining a small wooden grocery box with sheet plastic, or oilcloth. A discarded refrigerator tray, or a medium sized refuse can cover would also be suitable. For large jobs, use a wheelbarrow or bucket. A mortar board is a real timesaver and a necessity if you are doing even a small amount of work. Waterproof it with paint or varnish.

There are three ways commonly used for making tuckpointing mortar. You can use (1) Portland cement with lime, (2) masonry cement; or (3) pre-mixed preparations such as Sackrete Mortar Mix. Sackrete offers convenience in that it is available in hardware stores, and requires only the addition of water. However, you must follow the instructions on the bag closely. Especially avoid using too much water, which will tend to produce weak joints.

If you are using Portland cement, you must add lime to make mortar, because the cement and sand alone make a very stiff mixture. The lime is used to make it more plastic and formable. Masonry cement is a blend of limestone, finely crushed, and therefore mixes up into a pliable mortar, without adding lime.

Use mortar sand, or "Mason's sand," rather than common sand which may have particles too coarse for the required smoothness. Proportions are important, so follow the recommendations in the accompanying chart, adding just enough water to make a damp mixture. Then allow your mortar to stand untouched for one to two hours before use, after which remix it adding just enough water to make it plastic and workable. This method is highly recommended since it prevents shrinkage later in the tuckpointed joints.

During hot weather above 80 degrees, the mortar will tend to harden in about 2½ hours after mixing, while at lower temperatures it will take about 3½ hours. Keep the mortar box covered and damp. If the mortar stiffens because of hydration (setting) before you can finish using it, discard the mixture. It will only produce weak joints. The use of antifreeze materials in mortar for winter work is not recommended, since strength is impaired by these salts. Plan to do your tuckpointing early in the day, with temperatures well above freezing.

Tuckpointing joints. While you are waiting for your mortar mix to season is a good time to check the preparation of the wall. Be sure that you have chiseled out all the loose old mortar and that the joints are clean and free of dirt and, especially, oil or grease. The joints and bricks should be damp, but not soaking wet.

You can test your mortar by squeezing it. It should hold its shape without slumping down, and should not be fluid, as for poured concrete. Apply the first coat with a trowel, pressing hard on the mortar to force it into the joint. Do not disturb it

until it sets. When it is hard enough to take the impression of your thumb, come back to that part of the wall and apply a final coat. Use a tamping tool to make either a concave, or V-joint. (Such tamping tools can be improvised by bending a piece of ⅜-inch bar to make a handle.) These joints are recommended since they tend to best resist the penetration of water. The mortar should dry slowly, and for that reason, avoid tuckpointing in very hot sunny weather.

Caulking windows. Moisture around windows in masonry walls is often due to leaks in flashings above and below the windows, and between the frames and masonry. Before caulking, remove all loose paint from the wood, and then coat with a sealer, or primer and allow it to dry. Also clean the brick, as described previously. Caulking should be done at a temperature of 70°F. or more. The compound adheres to the surfaces, provided that they are clean and dry. It remains plastic for a long time, and forms a surface skin that takes paint.

Caulking compound is supplied in cans, or in cartridge tubes, which are more satisfactory for occasional use. The tube, with its nozzle, fits into a hand gun. Use the beveled nose of the nozzle to force the compound into the joint around the window frame. Move the gun at uniform speed pressing on the trigger with steady pressure to make an even good looking joint. A bead lying on top of the joint, while it may stick, is of little value. If it does not penetrate completely into the joint, force it down with a putty knife or thin stick, and go over it again with the gun.

Caulking will usually cure leakage from defective metal flashing. Scrape the flashing clean and if it is eaten through, tear it out. Widen small openings to admit the compound. Where wide joints occur, it is economical to drive in strands of oakum, which when properly tamped, is quite waterproof. Fill in the rest of the groove with caulking compound.

Patching stucco walls. Hairline cracks in old stucco walls will generally not leak unless they extend beyond the color coat and the intermediate coat. But wet freezing weather will enlarge such cracks, and therefore they should be filled. To patch large cracks, widen them with a narrow cold chisel, inclining the edges to widen the cavity inside in a dovetail shape. Usually this can be done without cutting down as deep as the metal lath or mesh backing. Dust out the hole, wet it, and use a trowel to apply stucco patching compound which is available at most hardware stores. This white powder can be tinted with dry color to match the wall, if a sample button of it is mixed and allowed to set and dry for comparison. Or the patched area can be painted to match after drying, if the coloring was not included.

If the cracks in the stucco are large and branching, cut out an area that will include them all. In mild climates, the stucco reinforcing often consists of hexagonal wire mesh stretched from stud to stud, without sheathing, and its asphalted felt backing is likely to break. A piece of cardboard inserted through a slit cut in the mesh will back up the patch. The cut mesh can be wired together. Stucco paint will seal small cracks and renew the surface color.

See also: CONCRETE; STUCCO.

RECOMMENDED MORTAR MIXES FOR TUCKPOINTING

1 part Portland Cement 1 part lime 6 parts sand Water	1 part Masonry cement 3 parts cement Water	45 lb. bag Sackrete Approx. 5 pints water

Blend thoroughly and use only enough water to make mixture pliable.

PVC cement is used to glue the pipes together. Begin with the three longest pipes, bundle them together with tape. Run a bead of the thinned cement into each groove and set aside.

Building a Directional Microphone for Experiment or Fun

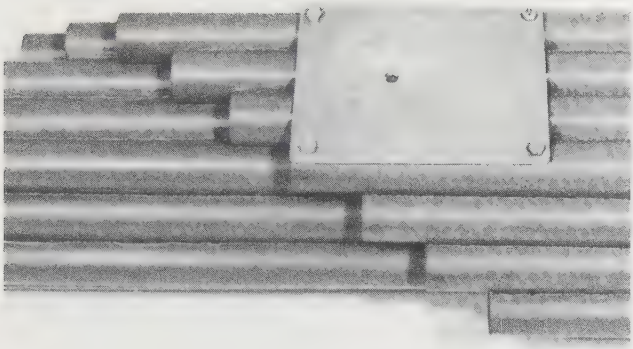
Uses resonant principles of organ pipes to amplify sounds, while destructive interference minimizes unwanted noise. You can build the mike as described here, but you will probably want to include some of your own ideas as well

A LINE MICROPHONE—sometimes dubbed either a "shotgun" or "machine gun" mike—utilizes the resonant principles of organ pipes to amplify sounds, and destructive interference to minimize unwanted sounds. The result is that you can listen to or record sounds that unaided microphones cannot detect.

Because a line microphone is highly directional, it is ideal for recording the sounds of animals, insects and birds. An imaginative naturalist can use the recorded sounds to analyze the often highly complex insect and bird calls by playing back at reduced tape speeds. There are many other practical applications for a line mike. Aboard a boat it can be used to locate the directions of fog-shrouded buoys or shore points. It can help locate children lost in wilderness areas. On the farm it can help detect prowling predators or wandering livestock. At a ballgame, you can listen to the conversation between the players and umpire. Perhaps you can even set up a line-of-sight communications system with a neighboring friend equipped with a similar line-mike system.

If you are looking for a truly fascinating science fair project, build one or more line microphones in an effort to develop the most efficient design. Although the mike shown here works well, it could undoubtedly be improved. Included here are some hints about potentially rewarding avenues of investigation. Some experimenters claim good results using small line mikes made

microscope: see photomicrography
microwave ovens: see electronic cooking
mildew: see painting, house
mini-beacon: see electronics



▲ *Tripod mounting plate, made of heavy gauge aluminum, is cemented with epoxy, screwed (with self-tapping sheet metal screws) to the balance area of pre-assembled pipe bundle.*

▲ *Completed organ pipe mike looks as neat as it is efficient, because the plastic tubes are cemented together, eliminating the need for extra binding straps. Note the handy tripod shelf holding a small tape recorder; and supplementary amplifier, an option.*

from bundles of soda straws; professionals use aluminum tube rigs up to six feet long.

How it works. Like the pipes of an organ, the tubes of a line mike amplify sound through resonance of those sound waves that enter the tube more or less from the front of the tube bundle. Sounds that enter from wider angles tend to get out of phase, and are partly destroyed by wave interference. It is a combination of these two phenomena that provide the high degree of directionality obtained with a line mike.

The reason there so many tubes of different lengths is to produce resonance of many different wavelengths, just as in a pipe organ. You can easily calculate what sound frequency resonates best in a tube of given length by using the following simple equation (for practical purposes assume the speed of sound is 1100 feet per second although the actual speed varies with atmospheric temperature):

$$\frac{\text{Speed of Sound in Air}}{\text{Tube Length in Feet} \times 2} = \text{Resonant Freq (cps)}$$

The tube length is multiplied by a factor of 2 because a tube open at both ends resonates at a wavelength twice as long as the tube itself. Using this equation, you find that a 3-foot tube resonates at a frequency of about 183 cycles per second, while a one-inch tube resonates at 6600 cps. Although the theoretical resonance range of the mike shown here is from about 178 cps (37-inch tube) to 6600 cps (1-inch tube), higher and lower frequencies will pass through but will not be efficiently resonance-amplified.

Although this line mike is much more directional than a bare microphone, or even one fitted with a parabolic reflector (another device for amplifying sound pickup), do not expect miracles. In very noisy areas (where there are low-flying planes, busy

highways, a flock of screeching blue jays) the mike will not pick up the sound of a caterpillar munching on elderberry leaves a hundred feet away. And remember that the mike will amplify *all* sounds in the line of aim, not just the sound you want to hear or record. For example, you may be perplexed by a persistent, loud background rumble during your preliminary recording tests. You are probably picking up traffic rumble from a busy highway behind the woods, which could be almost a mile away. When background noises that are *not* in the line of aim are bothersome, they can be minimized to a degree by the use of a simple tubular shield around the tube bundle.

Construction materials. Ordinarily, line mikes are built from aluminum tubing about ⅜-inch in diameter. If you are unable to find such tubing, look for a substitute such as *rigid* PVC pipe sold by a plumbers' supply house for use in cold water plumbing.

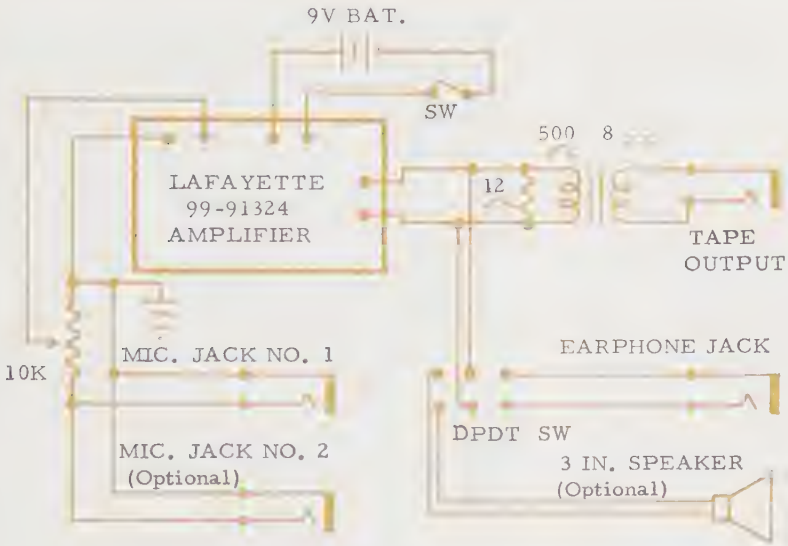
Admittedly the plastic pipe is heavier than aluminum tubing (which you should use if you plan to carry the rig for miles through the countryside); the total weight of the pipe bundle plus mike chamber is ten pounds, eight ounces. But the plastic pipe does offer some advantages: the tubes are easily cemented together to make a very sturdy unit; the pipe can be cut easily with a hacksaw; it will not dent if struck accidentally; it has no annoying metallic ring when handled during recording sessions; it needs no painting; it is ideal along the seashore because salt air will not corrode the plastic; and because it is fairly heavy, wind-caused vibration is minimized.

Pipe assembly. Cut the pipe stock into 37 different lengths, each one inch shorter than the preceding pipe. The longest is 37 inches; the shortest, one inch. Clean the pipe thoroughly using a rag dampened with PVC cleaner or with ordinary lacquer solvent. Work out of doors and avoid breathing the solvent vapors. The PVC cement is easier to use if thinned with solvent. Use two parts of cement plus one part of lacquer solvent to provide a consistency that will run out of a medicine dropper easily, but not too freely. Mix only a little cement at a time because you won't need to use all the cement in the can.

Bundle the three longest pipes together with paper masking tape, making sure that they are squared off neatly at one end. Now run a bead of thinned cement into each groove where the pipes touch each other and set aside for ten or fifteen minutes. Keep adding progressively shorter pipes, holding them in good contact and alignment with the first pipes. After all pipes have been joined, set the assembly aside overnight to give the cement time to harden thoroughly. If done properly, you will have a sturdy and neat unit. Try not to dribble the cement onto the pipes, except where the joinings are made, because it corrodes the plastic.

Mounting rims. Viewed from the rear, the pipe bundle is seen to form a bumpy sort of hexagon. To facilitate the addition of the microphone chamber, add a mounting ring, one inch wide, cut from one end of a coffee can six inches in diameter. Stand the pipe bundle on end and slide the ring into position. To lock it in place, pack the spaces between the ring and the pipes with No Drip Tape, a plastic pipe-covering material plumbers use to prevent cold water pipes from sweating. Cut the somewhat sticky tape into small chunks and pack firmly into place using the end of a wooden dowel. This simple bonding method not only locks the ring firmly in place, but also plugs up holes that would let unwanted sound into the microphone chamber.

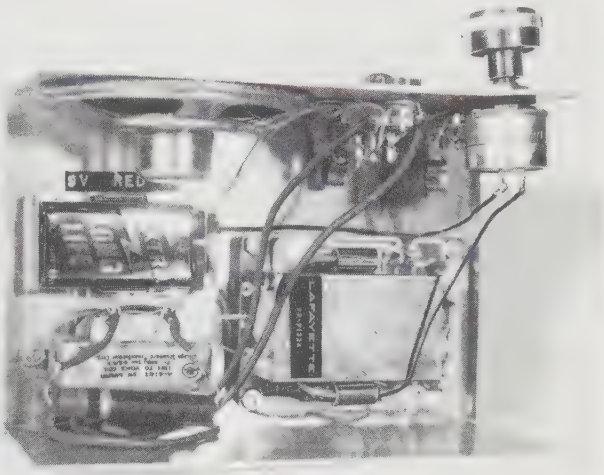
Mike housing. The microphone housing is made from an old lamp shade of the kind used on gooseneck desk lamps. You can use other types of housings, but try to stick with metal (rather than use plastic) because it will serve as a shield to prevent



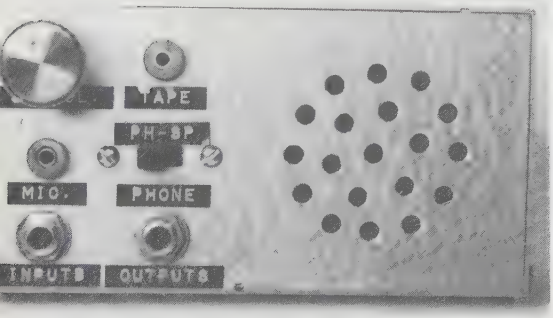
Circuit connected to the Lafayette modular amplifier may be more complicated than you need. Check other electronics suppliers for amplified modules that may be more suitable.

audio feedback between the microphone and your monitoring earphones.

Rivet three strips of spring metal to the rim of the housing, as shown, and bend them so that they will clip onto the mounting rim. You can also use bits of strapping metal that came off a shipping crate. The easiest way to get a tight joint between the mike housing and the rear of the pipe bundle is to cement a strip of U-shaped window channel material (rubber or plastic) along the edge of the housing. A local garage may be able to provide a scrap of chemical



Amplifier components fit neatly into mailbox.



Optional amplifier has two microphone inputs, outputs for earphones, tape recorder.

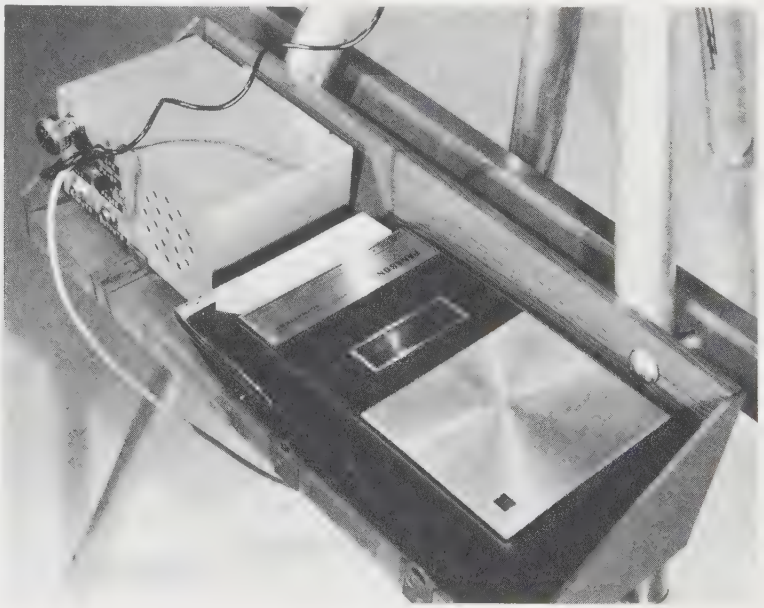
material left over from a car window repair job.

Fasten a small microphone to the inside of the housing. If the mike has an easy-to-remove plastic back, drill a hole through it and simply bolt in place through a hole drilled in the housing. The crystal mike can have a lapel clip somewhat like that on a fountain pen. Simply bolt a small, square "ring" to the rear of the housing to which the mike could be clipped. Run the mike cord out through the large hole ordinarily used to screw the lamp shade to a socket. To keep out dust, and to absorb strain on the mike cord, fit a large rubber stopper into the hole after slitting it lengthwise, half way through, so that the cord can be inserted into the stopper before it is pushed into place.

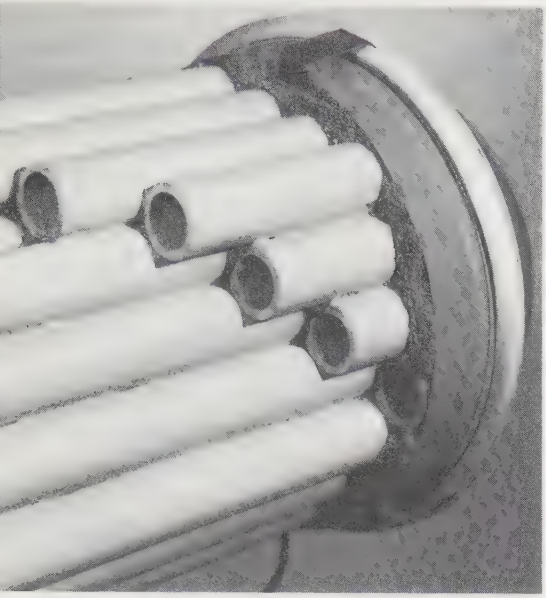
Tripod mount. Your line mike is most conveniently supported on a sturdy camera tripod. Lacking this, rig up some sort of support that will permit the tube bundle to be swung sideways and up and down.

The tripod mounting plate is cut from thick aluminum plate. A 3 x 4-inch plate is about right. Drill small holes near the four corners for attaching to the plastic tubes using self-tapping sheet metal screws. These will hold the plate on firmly, but for a still more secure job add a bead of epoxy cement along the pipes where the plate will make contact, then screw in place. Before mounting, drill and tap a hole into the plate that will take the camera-mounting bolt on your tripod. If you lack the tools, your local garage can do the job quickly. Try to place the plate close to the balance point of the pipe assembly. This probably will be just to the rear of tubes 13, 14, 15 and 16, counting from the rear of the bundle.

Supplementary shield. Your line microphone is now ready for use. Plug it into a portable tape recorder, or just use it for listening by using a suitable microphone amplifier. If operating conditions calls for further reduction of unwanted noise, try using a supplementary shield around the pipe bundle. This is most easily made from a 37-inch length of stove pipe, 6-inches in diameter. Just cut a rectangular hole in the pipe opposite the tripod mounting plate. Or you can make an experimental tube from corrugated cardboard by scoring a

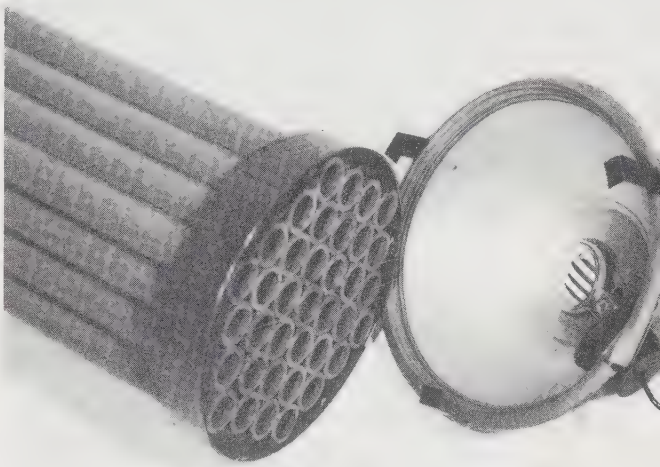


Tape recorder shelf should be proportioned to fit your equipment and tripod. Two carriage bolts hold the shelf firmly on the tripod. The shelf could also be useful for holding photographic materials.



Large gaps between the pipe bundle and the metal ring (cut from a large-size coffee can) are filled with chunks of a slightly sticky plastic tape used by plumbers. Note how spring clips hold the mike chamber in place.

Microphone chamber, made from an old reflector, locks onto rear of pipe bundle with three spring clips. Rubber stopper serves as a strain-eliminator for mike cord. Plastic or rubber U-gasketing provides a good seal.



3-foot length every 3 inches, lengthwise, and bending it into a hexagonal (not round) tube to slip over the pipe bundle.

Optional amplifier. If you have a portable tape recorder, you may have to do nothing more than plug the mike into the recorder, However, if the recording signal does not seem strong enough for your needs, you may wish to interpose a small battery-powered amplifier between the mike and tape recorder. Or you may want to use an amplifier just to activate a set of earphones. In any case, since you will be working out-of-doors, play safe by sticking to a battery-powered amplifier.

The experimental amplifier shown here utilizes a 3-watt, 4-transistor module. Other modules are also available, so pick one to suit your needs and budget. Each module comes with a circuit diagram and general directions for making connections to the amplifier circuit, therefore, only a few brief comments about the amplifier are necessary.

The speaker is optional, and was added so that the amplifier could also be used for other experimental purposes. Note also that there are two microphone jacks, wired in parallel, one to accept a standard phono plug, the other a miniature plug often found on small mikes used with portable tape recorders. You may wish to eliminate one of these jacks.

The amplifier module has an input impedance of 2000 ohms and a choice of an 8 or 16 ohm output. If you use a crystal microphone to obtain greater pickup sensitivity than is offered by the dynamic mike you may now be using with your tape recorder, it may be necessary to add an im-

pedance-matching transistor-type input transformer between the mike and amplifier. But first try it without the transformer since you may not need it.

The output of the amplifier may turn out to be more of a problem if the portable tape recorder is badly overloaded when hooked directly to the amplifier. A 500 ohm/8 ohm output transformer wired as shown in the circuit diagram helps a great deal. But there may still be some erratic squealing which can be eliminated by switching on the small speaker in the amplifier. Since the speaker could create feedback problems with the mike, a high-wattage 12-ohm resistor was wired into the circuit as a load. This solved the problem; yours may be different.

Bear these precautions in mind when you connect your amplifier module to the rest of the circuit. Be sure that the 9-volt transistor battery terminals are connected correctly (observe polarity according to the manufacturer's directions). When wiring the mike jacks, connect the ground side of the circuit to the "common" terminal on the printed circuit board, and lead the "in" terminal to the center lug of the 10K pot. If the pot (volume control) works backwards, switch the leads on the two outside terminals. Although not shown on the diagram, the power switch is integral with the volume control. The entire assembly is mounted in a 3 x 4 x 6-inch aluminum box. The speaker is cemented to the box with epoxy cement after the holes have been laid out and drilled with a $\frac{3}{16}$-inch diameter drill. Use insulating spacers to keep the underside of the module circuit board from touching the bottom of the box. You can use quarter-inch lengths of plastic tubing.

Tripod shelf. If you do a lot of recording with your new system, a tripod-mounted shelf for the amplifier and tape recorder will be a great convenience. The photo shows how it is put together, but dimensions are not given because you should tailor yours to fit the size equipment you have.

As already mentioned, this line microphone works quite well, but you may be able to design a much better one. Here are some notions that might be worth investigation.

How important is the tube diameter to maximum efficiency? Is metal better than plastic, or vice versa? Do the spaces between the tubes affect performance adversely, or do they in effect act as additional pickup tubes despite their non-circular shapes? Would there be any advantage (or disadvantage) to using square rather than round tubes? What would be the ideal size and shape of the microphone chamber? Are there ways to increase the directionality of this particular design? Perhaps by dividing the individual tubes into half or quarter sections with baffles inserted lengthwise? What would be the effect of packing the large tubes with soda straws joined end to end to produce a very large number of small tubes? And if you play around with the stovepipe shield, try lining it with sound-absorbing material like felt, or make a shield from acoustic wall and ceiling material. Would such modified shields be more effective in absorbing unwanted sounds?

Finally, could the line microphone be used in reverse? Could you replace the microphone with a speaker in order to beam sound outward from the unit? Would the beamed sound be more directional than from an ordinary speaker? What use could you make of such beamed sound?

Remember that many of these questions could probably be answered by first making small line microphone units. When you get the answers, you may be able to build a unit far better than this one. Maybe one that will win a prize at your next science fair. J.H.

See also: ELECTRONICS.

Building a Highly Sensitive Parabolic Microphone

Whispers 100 feet away, bird calls 150 feet away—only two of many fascinating experiments you can try with this directional unit

With earphones plugged into the output jack of a recorder, you can monitor the incoming sound. A disc (not shown) should be mounted in front of the mike to absorb unwanted sound.

A PARABOLIC REFLECTOR made of a disc sled performs like equipment used in broadcast and detective work to pick up sounds hundreds of feet away.

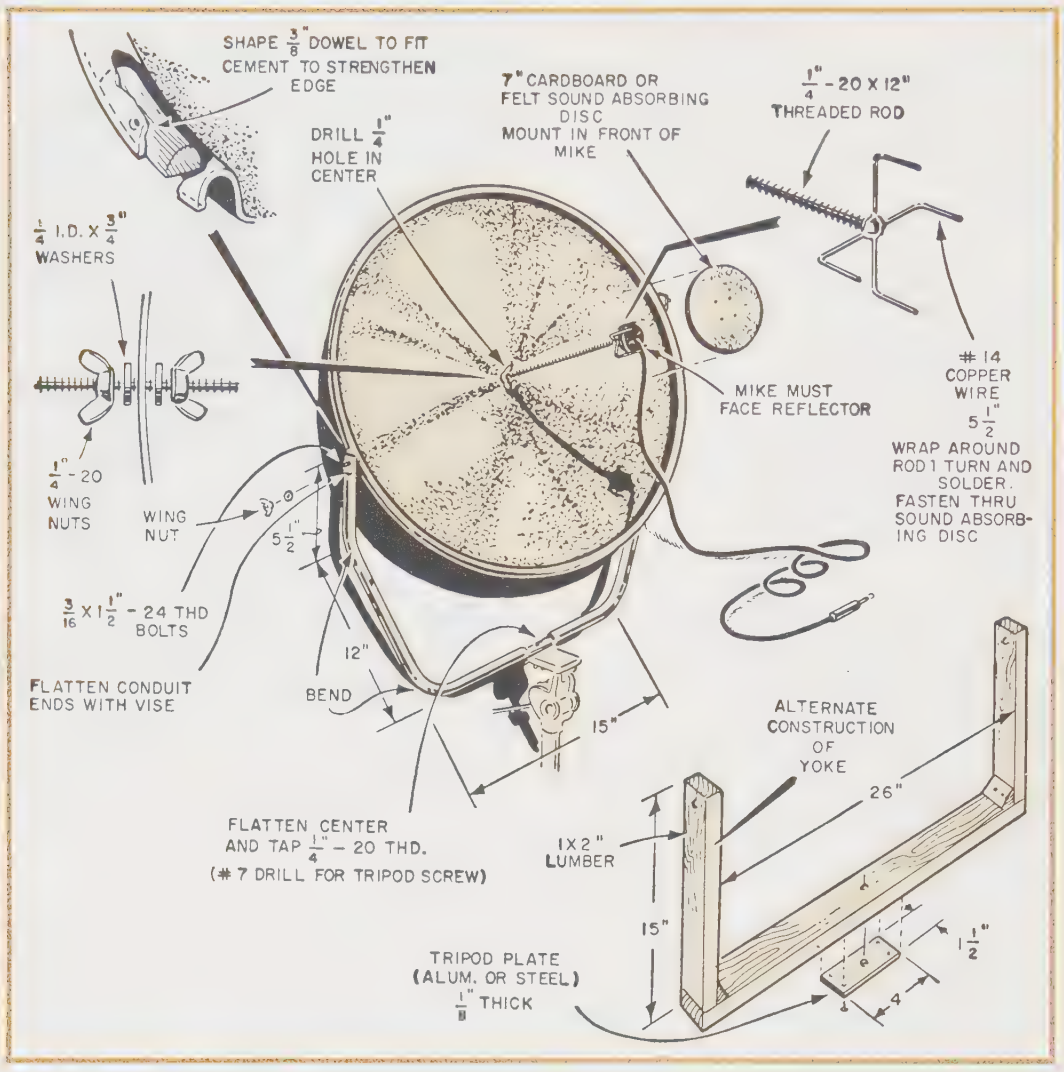
With a Voice of Music tape recorder and an Astatic microphone, this parabolic mike detected whispers at 100 feet and normal speech at 150 feet. Bird calls were recorded at 150 feet, although the disc is not selective enough to pick out a single bird call among many. For broadcast use, the unit was set up on top of the grandstand at a football game, and allowed radio broadcast of band music from the other side of the field which was almost drowned out by other noise picked up by a standard microphone.

The bright orange sled, with the station call letters painted on, was quite an attention getter. The operator wears phones connected to the broadcast amplifier so he can monitor the aiming of the dish, pointing it in any direction the announcer may call for.

This dish gives a definite boost to mike sensitivity. Tests indicated that a good 3-foot parabola gave a 10 db gain, or a voltage gain of 3.16 times; and a 10 times boost in power output.

The reflector is made of a fiberglass sled. Remove the handles, and locate the center of the 26-inch dish by laying a yardstick across at the widest point and drawing a line. Then lay the yardstick across again, at a right angle to the first line and mark an X at the disc's center. Drill a ¼-inch hole for the threaded microphone support rod.

Make the U-shaped yoke by bending a 4-foot length of ½-inch electrical conduit. An electrician's conduit bender makes the job easy. (You can also make the yoke of three lengths of 1 x 2-inch lumber.) Flatten the bottom center part of the U and tap a ¼-20 thread for camera tripod mounting. Also flatten the top ends of the U and drill the $\frac{3}{16}$-inch holes for the swivel screws. Attach the yoke to the disc by drilling $\frac{3}{16}$-inch holes on each side for $\frac{3}{16}$-14 thread


SHAPE 3/8" DOWEL TO FIT
CEMENT TO STRENGTHEN EDGE
DRILL 1/4" HOLE IN CENTER
7" CARDBOARD OR FELT SOUND ABSORBING DISC MOUNT IN FRONT OF MIKE
1/4" - 20 X 12" THREADED ROD
1/4" I.D. X 3/4" WASHERS
#14 COPPER WIRE 5 1/2"
WRAP AROUND ROD 1 TURN AND SOLDER. FASTEN THRU SOUND ABSORBING DISC
MIKE MUST FACE REFLECTOR
1/4" - 20 WING NUTS
WING NUT
5 1/2"
3/16 X 1 1/2" - 24 THD BOLTS
FLATTEN CONDUIT ENDS WITH VISE
12"
BEND
15"
ALTERNATE CONSTRUCTION OF YOKE
26"
FLATTEN CENTER AND TAP 1/4" - 20 THD. (#7 DRILL FOR TRIPOD SCREW)
1X2" LUMBER
15"
1 1/2"
4
TRIPOD PLATE (ALUM. OR STEEL) 1/8" THICK

x 1½-inch bolts and wingnuts. Tighten these nuts just enough so that the assembly is free enough to swivel.

Your microphone and amplifier should have as much gain as possible. Most tape recorders will work, and allow recording while you monitor with earphones plugged into the output jack or the monitor jack. A PA amplifier will work if it has provision for earphones instead of a loud-speaker. Your regular recorder mike can be used unless it is unusually large or heavy. Lapel mikes will also do the job.

If you decide to order a mike, be sure to specify the proper impedance for your tape recorder or amplifier. Most tape recorders are high impedance, and if the figure is not mentioned in your instruction book, take the unit to an expert, or to your dealer for matching.

Make the mike support rod of a 12-inch length of threaded rod obtainable at hardware stores. Solder two 8-inch lengths of #12 or #11 bare copper wire in an X across the end of the rod. Bend the wires forward and tape them to four points around the edge of the mike, keeping the mike's face an inch or two from the end of the rod with the live side facing the disc. Then you can bend the copper wires to center the mike on the rod.

Mount the yoke on a photoprapher's tripod, or improvise a pipe stand and you're ready for a test. Set up the gear in a quiet location outdoors. Remember to take safety precautions in using no equipment that has a hot chassis that can be connected to either side of the 120 volt supply cord. Also avoid working on damp ground.

Screw a wingnut on the mike support rod to about four inches from the mike. Place a washer on the rod, and push it through the hole in the disc. Mount another washer and nut on the back side. Set up your amplifier and listen on earphones as you point to a constant sound source about 50 feet away, such as a code oscillator or someone counting in a normal voice. Slowly adjust the threaded rod in and out until you find the point at which the sound is clearest.

You will find that the sound is more brilliant at the focus, becoming slightly "bassy" on either side of the focal point. When you find it, lock the rod assembly. No further adjustment is needed unless you change microphones. Many mikes can be improved a bit in some locations by adding a 6- or 7-inch disc of felt or fiberglass to the dead side to block out unwanted sound.

The principle of the sound detecting mike is that the curved surface reflects sound waves from directly in front to a focal point. Unwanted noise from angles to the side is bounced back out. The dead side of the microphone is toward the source of sound, so what you record is only by reflection.

Parabolic microphones have also been made from surplus radar reflectors which use a similar principle. Also, small pickups can be made from old style automobile headlight reflectors as well as from electric heater reflectors—the old type that had a bowl at least a foot in diameter. J.B.T.

See also: ELECTRONICS.

WHERE TO FIND IT

Suggested lapel microphones include 99C4510 or 99C4113. Microphone cartridges 99C4509 may also be used. These microphones are available from Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset, N. Y. 11791.

MATERIALS LIST

Quantity	Size and Description	Purpose
1	25″ diameter fiberglass sled	reflector
1	1/2″x4′ electrical conduit	yoke
1	1/4″-20x12″ threaded rod	mike support
2	1 1/2″x3/16″-24 thread bolts with wingnuts	
1	16″x#14 copper wire	
1	7″ sound absorbing disc	

NOTE: Also need electrical tape, tap and drill.

Choosing the Right Minibike

You need dependability and safety, not high-priced extras

ALONG WITH the recent trend in recreational vehicles sales is the minibike segment of the two-wheeled set. These bikes are the simplest vehicles around; they have two wheels, a motor, and just enough other bits and pieces to keep things together. That is not the key to their popularity though, they just happen to be fun to ride, and although the machines are primarily intended for the kids, the parents are often seen scooting around on the pint-sized bikes as well. It is great fun, and having fun is the purpose of owning a minibike; they do not purport to be practical at all or even a street-legal means of transportation, just a fun machine for use in the backyard or around the campsite. True, there are manufacturers who now produce minibikes that are acceptable street vehicles in some states, but by and large the safest place for the bikes is not out on the road.

The minibike market has grown so rapidly with the range of equipment getting bigger and better and so much more sophisticated, that minibike companies are now actually producing small motorcycles, not minibikes. Too, motorcycle manufacturers have extended their lineups down to minibike proportions (they call these bikes "minicycles"), so that drawing the line between minibike and motorcycle is not so easy any more. The longstanding definition of a minibike has always focused on the small tire size as the delineating factor. Any two-wheeled vehicle with narrow wheels less than 12 inches in diameter can be termed "minibike."

Because the vehicles by their very nature are so sparse and uncomplicated to the layman's eye, there hardly seems to be that much to consider when shopping around. But actually there are important areas of the bikes which separate the good buys from the bad deals which are usually offered by new, small companies trying to get in on the action.

Obviously, since there is so little else there, the engine is the heart of any minibike. The motors come in different sizes and designs (two-stroke and four-stroke), but the majority of the manufacturers are using small, air-cooled industrial engines similar to the powerplants commonly found on yard equipment. These motors are very durable and compact. And for slow going, 10 to 15 mph top speeds, they are quite suited to the application. The super minibikes now feature highly efficient engines specifically designed for that particular bike coupled to three and even four-speed transmissions, enabling those bikes to cruise along quite happily at 40 mph, and even more. They probably exist because of the American affluence and desire for ultimate in equipment whether it be a camera,

mini-hydrofoil: see racing boat
mini rotary engine: see rotary engine, mini
mini-workshop: see tool caddies
mirror: see cabinets
mirror, vanity: see vanity

watch, car, or whatever. In so doing they have functionally escaped the realm of "minibike" even though their dimensions fit the description.

On the question of four-stroke versus two-stroke, if a child will be doing most of the riding on his own it is best to stick with a four-stroke engine. The two-strokes, unless they are one of the super-sophisticated Japanese models with automatic oil injection, require precise premixing of the oil/gas fuel. The mixing ratio is critical and difficult for a child to handle. The consequences for a motor running on the wrong fuel mixture is either plug fouling, the motor stalls and will not start, or overheating which could cost you the whole motor.

The method of power transmission from the engine back to the rear wheel varies from bike to bike with the most expensive jobs having three or four-speed transmissions with either a manually operated or automatic clutch. The less expensive bikes

usually have only one speed and a direct drive from a centrifugal clutch by chain to a sprocket on the rear wheel. A compromise between those two extremes is a variable drive system or torque converter used on many of the newer models. This system is simple, inexpensive and solves the problem of worn-out clutches, a weak point on many of the one-speeders. Of course, the torque converters do come at some extra expense but the money will be well spent.

Next, take a look at the tires. Again, the bikes falling into the minibike category will have wheel diameters of 12 inches or less and the tread design should be knobby. Smooth tread patterns more intended for the street give very poor traction in the dirt or grass, and that is where you should be doing most of your riding. Also look for a 4-ply rating on the sides of the tires to make sure you won't be spending a good bit of your time fixing flats.

The next part of the bike to consider is the brakes. Does it have both front and rear brakes? If the top speed is in excess of 20 mph make sure the bike has both brakes. Minibike brakes fall into two categories: disc and drum. Experience has shown that the disc units are not as good as the drum brakes because of the manufacturers' poor execution of the disc design. Theoretically the discs should be better, but most manufacturers have skimped on the quality of materials. Stay away from minibikes without brakes unless the top speed is less than 10 mpm. With that type of gearing just shutting off the throttle will stop you quickly, and at those speeds it is hard to get into emergency situations anyway.

Another point of minibike construction is whether or not it has a working suspension. Many bikes have their wheels fixed directly to the frame with no allowance for movement. This means very rough and sometimes painful riding if you hit obstacles in the field or on a trail. Shock absorbers are a must if you plan any type of trail riding at all. If the minibike does not go along on the camping trip and stays confined to the backyard, you can get away without a suspension. (Actually if you plan on trail riding you really need a trailbike, not a minibike. The former falls under the motorcycle category and will suit your needs with comfort and more safety than you can get with a minibike.)

Other checkpoints include running gear and accessories. If you think you will ever hit any water, full coverage fenders are a must. Lighting is optional. There is not too much minibike riding at night, but lights never hurt if you can afford the extra cost. As for the seat, make sure it fits you well especially if you are buying one of those jobs without any suspension. That seat padding is all the cushioning you have. Another thing to put on your list of things to check out is the muffler. Please, for the sake of all of us who enjoy bike riding, make sure your bike has a large and quiet muffler. Riding a noisy bike is only going to irritate your neighbors which is bad for you, and every other biker in the area. Noise has been giving the two-wheeled sport a bad name from the start; seeing that your bike is quiet is the first step toward better public relations.

Finally get to the price. All of the extras and options that have been mentioned are going to cost you. Minibikes run from a low price of $130.00 clear up to and over $500.00. Naturally there is a big difference between those two machines, but make sure you really need all the extras before laying out any additional cash. If all you want is something for your child to use in the backyard under supervision, the $130 job might be all you need. If, on the other hand, you want to do a little trail riding and want your machine to be street legal, your requirements have already put you in the $300 bracket. It is simply a matter of seeing that you have just what you need and no more to get the best buy.

How to Repair Electric Mixers

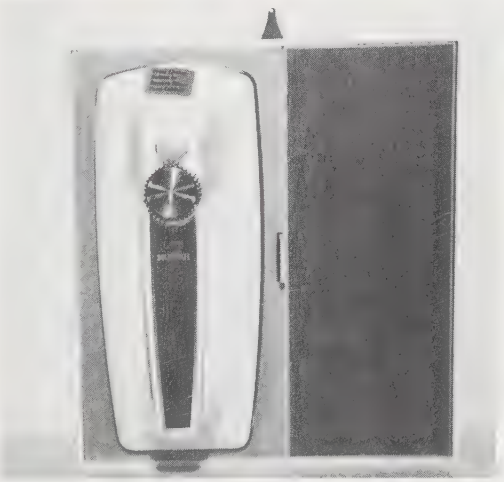
Most things that can go wrong with an electric mixer are easy to repair. Here's how to do it

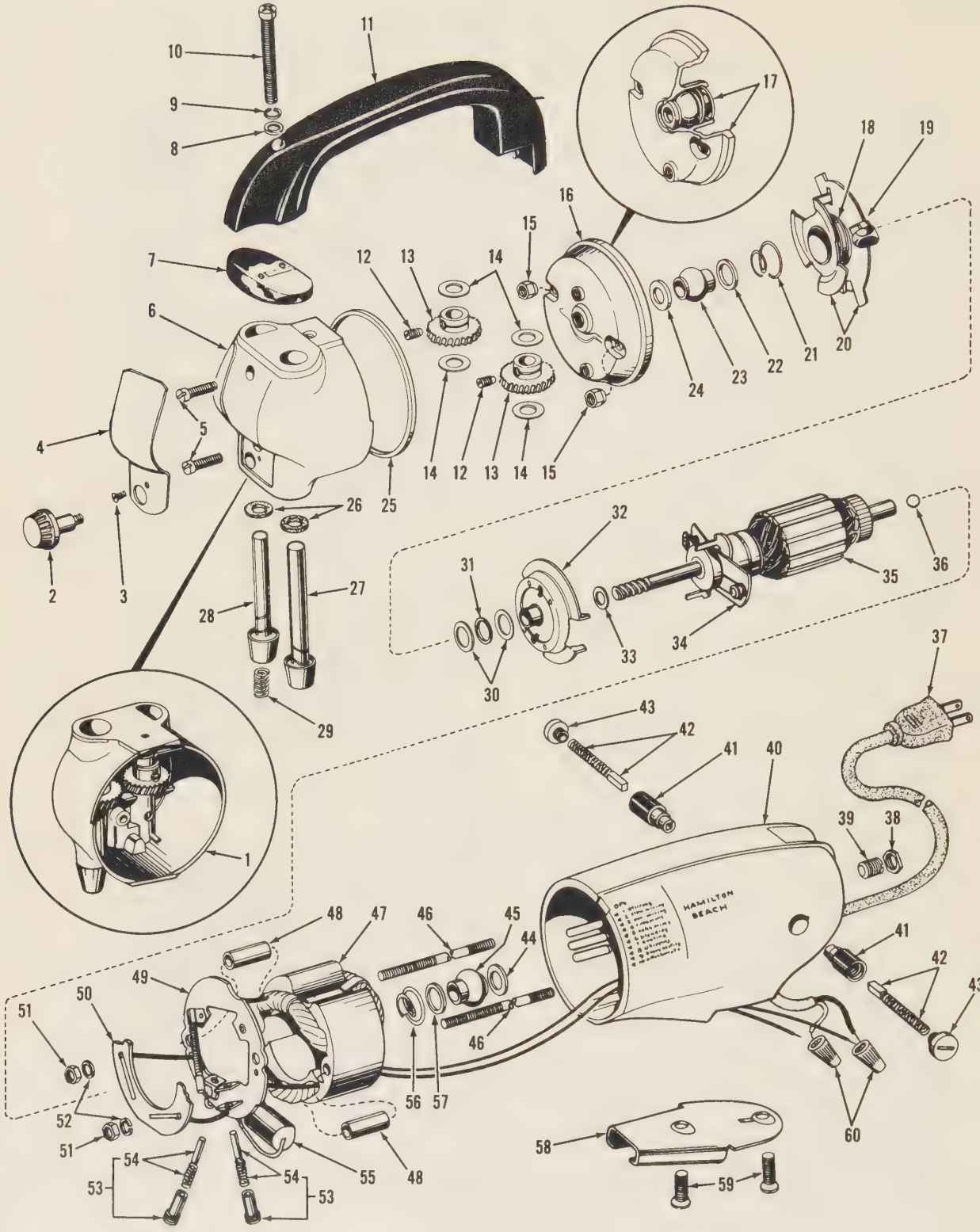
YOUR FOOD MIXER is the secret of those light, fluffy cakes your wife has been making. Its range of speeds allows her to use just the right touch for whatever is cooking. So, if you want to continue eating cake, you had better know how to help care for the mixer.

Normally, not too much goes wrong with a mixer. Accidents can happen—a spoon might get caught in the beaters or the mixer might fall off the counter resulting in damaged beaters. Sometimes the damage is stripped beater gears, cracked housing or a broken handle. These are easy parts to replace; as is a damaged cord.

Basic construction and operation. Most mixers are powered by a small high-speed series motor that is geared down to the slow beater speed through a worm gear on the end of the armature shaft. This worm gear meshes with the beater gears which drive the beaters. Speed control is obtained by either a tapped field coil winding or by a governor and resistor circuit.

All of this is enclosed in a plastic case. Often the most difficult part in servicing a mixer is determining how to open the case. Some manufacturers hide the assem-

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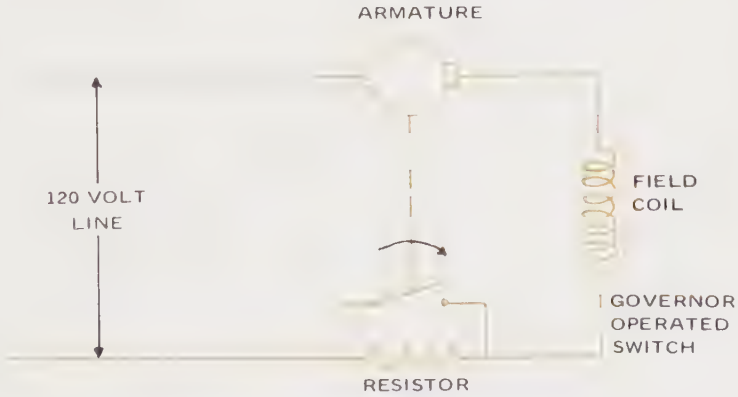
REF. NO.	PART NAME	QTY.
1	Gear housing complete with gears, shafts, set screws and felt packers	1
2	Mixing unit retaining screw	1
3	Front plate retaining screw	1
4	Gear housing front plate	1
5	Gear housing to motor screw	2
6	Gear housing only	1
7	Gear housing top plate	1
8	Handle screw washer	1
9	Handle screw lockwasher	1
10	Handle screw	1
11	Handle	1
12	Worm wheel set screw	1
13	Worm wheel with set screws	2
14	Worm wheel washer .027″-.030″	3
14	Worm wheel washer .023″-.026″	As Required
14	Worm wheel washer	As Required
15	Motor cover retaining nut	2
16	Motor cover only	1
17	Motor cover complete with bearing, felt washer & spring	1
18	Control cam spring	1
19	Regulating ring complete	1
20	Regulating ring and cam complete	1
21	Bearing spring	1
22	Bearing spring felt	1
23	Bearing	1
24	Bearing felt oil retainer	1
25	Gear housing gasket	1
26	Packing	2
27	Long gear shaft with coupling	1
28	Short gear shaft with coupling	1
29	Agitator tension spring	1
30	Fibre thrust washer	2
31	Steel thrust washer	1
32	Speed control plate	1
33	Retaining disc insulating washer	1
34	Governor complete	1
35	Armature with governor and thrust ball	1
36	Thrust ball	1
37	Cord complete	1
38	Thrust screw lock nut	1
39	Thrust screw	1
40	Motor case with bearing, spring brush holders and studs, and mixguide plate	1
41	Brush holders	2
42	Carbon brush and spring	2
43	Carbon brush screw	2
44	Bearing felt oil retainer	1
45	Bearing	1
46	Field studs	2
47	Field core, coils, slip ring brush holder plate and contact plate	1
48	Brush holder plate spacer	2
49	Resistor plate w/condenser comp. 90-130V	1
50	Contact plate complete	1
51	Field core retaining nut	2
52	Retaining nut lockwasher	2
53	Governor slip ring brush holder, brush and spring	2
54	Governor brush and spring	2
55	Condenser 76-130V	1
56	Bearing spring	1
57	Bearing spring felt	1
58	Motor bracket	1
59	Motor bracket screws	2
60	Wire nut	2

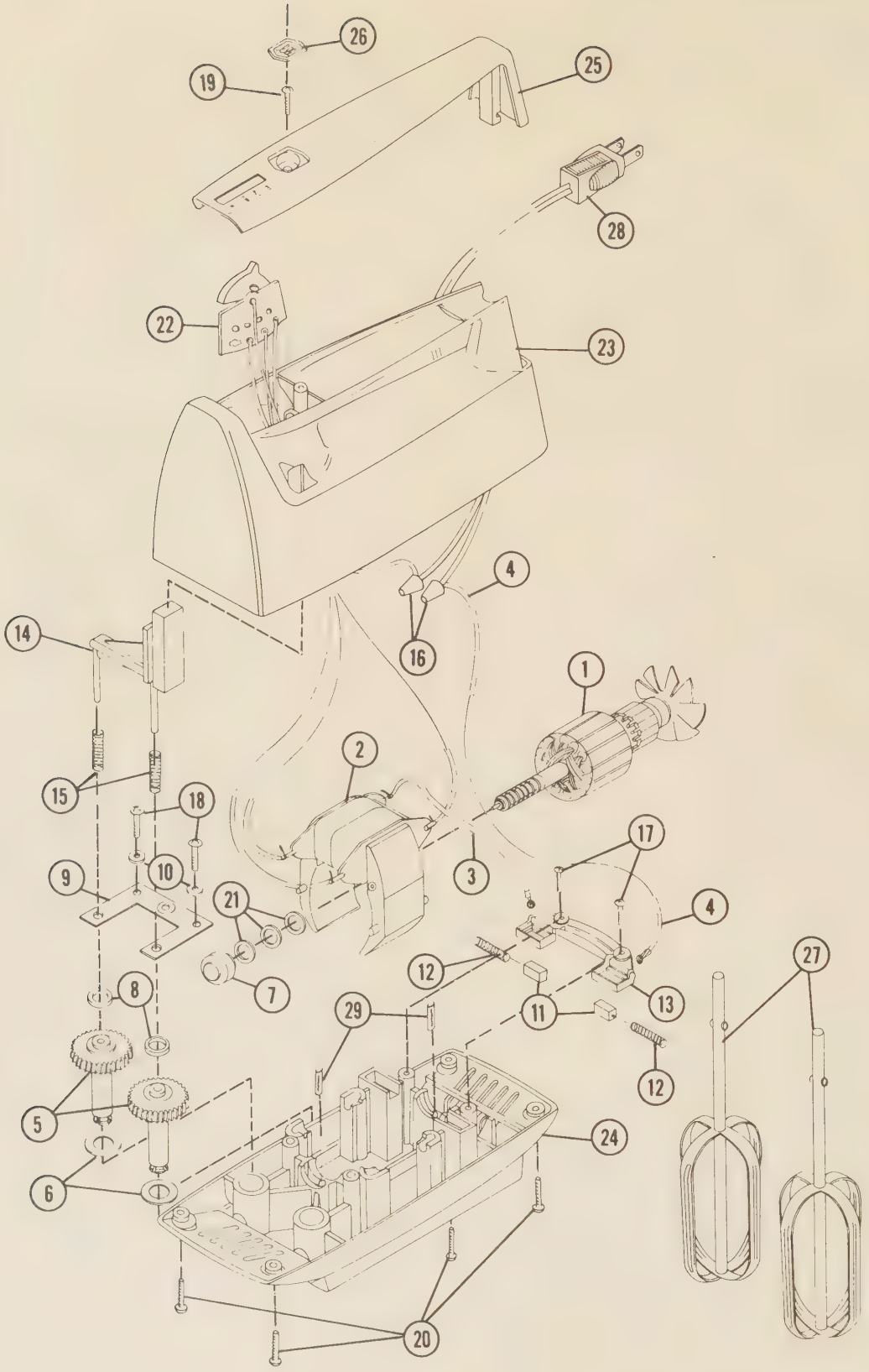
bly screws under a nameplate. Some mixers come apart fore and aft. Others will open top from bottom. A careful examination of the case will usually determine which approach to use.

Replacing damaged beater gears. When the motor runs and the beaters fail to turn, you must suspect damaged beater gears. Each beater has its own drive gear and even though only one is damaged, both should be examined and if there is any question, both should be changed. Note that in many models there will be a left hand and a right hand gear. Each is different.

When reassembling the beater gears make certain that they are timed to allow the beaters to be offset from each other by 45°. This will prevent the beater blades from hitting each other. Also repack the

This mixer is typical of those with governor speed controls. The governor (34) operates with the speed control plate (32), regulating ring (20), contact plate (50), and resistor plate (49) to switch the resistor in and out of the circuit. The resistor is wired in series across it, as shown in the schematic drawing.

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A simple four-position switch regulates the speed of this mixer which is equipped with a tapped-field-coil speed control.

REF. NO.	PART NAME	QTY.
1	Armature	1
2	Field Coil Assembly	1
3	Lead Assembly 3″	1
4	Lead Assembly 5″	1
5	Gear and Sleeve Assembly	2
6	Washer, Beater Sleeve	2
7	Bearing	1
8	Felt Washer	2
9	Retainer, Bearing	1
10	Washer 3/8″ ODX 1/32	2
11	Brush, Commutator	2
12	Spring, Brush	2
13	Retainer, Bearing and Brush	1
14	Beater, Ejector	1
15	Spring, Beater Ejector	2
16	Wire Connector	2
17	Screw 6-20x1/2	2
18	Screw 6-20x3/8	2
19	Screw 6-20x9/16	1
20	Screw 6-20x3/5	4
21	Washer, Spacer	3
22	Switch	1
23	Upper Housing	1
24	Lower Housing	1
25	Handle Cover Assembly	1
26	Cartouch Plug	1
27	Beater	2
28	Cord Assembly	1
29	Oiler Felt, Bearing	2

beater area with a clean light grease. Do not use oil as it will seep down along the beater shaft into the food being mixed.

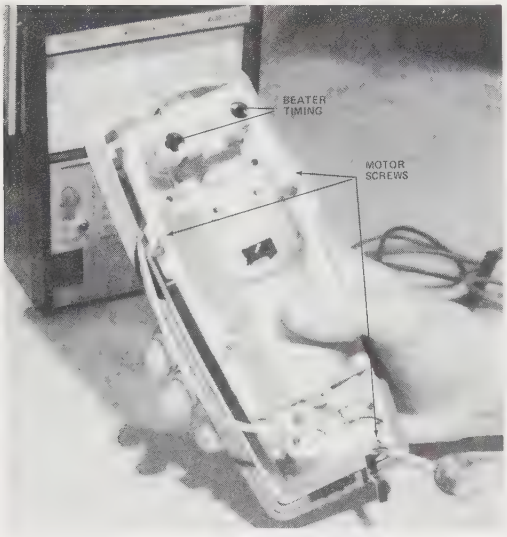
Speed control and operation. Any defect, either in the switch or the governor control, will affect the speed of operation. A defect in the field coil winding will prevent the mixer from operating at any speed setting, except in models which have a tapped field winding. Here, a break in coil B will prevent operation in the low-speed position and a break in coil A will allow operation at high-speed only.

A break or open circuit in the armature winding will cause excessive sparking or overheating. It may also cause low power or no operation at any switch position for any type of speed control system.

TROUBLE-SHOOTING
ELECTRIC MIXERS

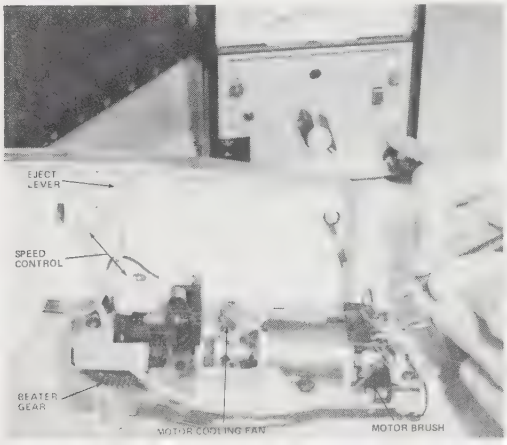
PROBLEM	POSSIBLE CAUSE	DEFECTIVE CORD	DEFECTIVE SWITCH	OPEN MOTOR WINDING	FROZEN BEARING	JAMMED BEATER	STRIPPED BEATER GEARS	INCORRECT SPEED SETTING	MIX TOO HEAVY	SHORTED WINDING
MOTOR DOES NOT RUN				\						
BLOWS FUSES										
MOTOR RUNS, BEATERS DO NOT							\			
ERRATIC OPERATION										
SLOW SPEED										
MOTOR RUNS HOT										

Removal of three screws—one at the back and two side by side near the front—allows the case to be opened to expose the motor.



The mixer motor assembly is held in the top half of the case by three screws. Note the position of the beater sockets. They are offset 45 degrees so the blades of the beaters will mesh.

All electrical tests can be made with the motor out of the case.



Brushes make the connection from the armature to the rest of the motor and should be replaced when they are worn to ⅓ of their original length. Worn brushes will cause excessive sparking at the commutator and may cause a loss of power. Do not oil brushes! It will make them sticky in their holders causing poor contact to the commutator and excessive sparking. Oiling brushes will also shorten their life. They must slide freely in their holders.

A defective cord can cause erratic operation when it is wiggled while plugged in. Voltage must be available at the machine end of the cord when it is plugged in. It is usually best to replace a cord rather than to repair it.

Replacement parts. Beaters, handles, cases and switches are designed for specific brands and models. They are usually available only at the store from which the product was purchased, or from the manufacturer who made the machine. These parts can be replaced without too much difficulty or cost.

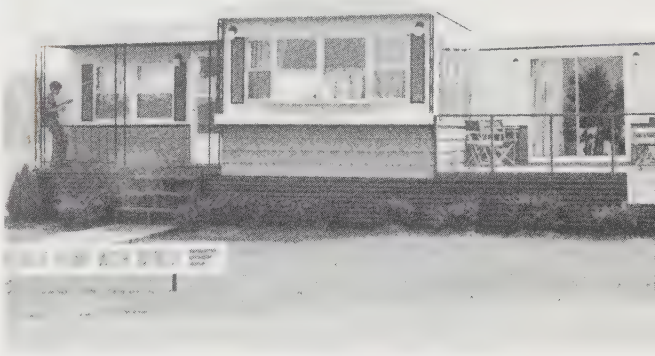
If either the armature or the field coil is open (burned out), it will have to be replaced. Generally, replacement parts will have to be obtained from the manufacturer or an authorized dealer for that particular brand. At this point you should check costs because it may be more economical to buy a new mixer.

By using the exploded views shown here and the accompanying trouble-shooting chart, you should be able to handle any service problem on your mixer.

See also: APPLIANCE REPAIR; ELECTRICITY; WIRING, ELECTRICAL; INDIVIDUAL APPLIANCE LISTINGS.

Shopping for Mobile Homes

These living units sometimes are good buys, but only if you know what to look for



ABOUT A HALF A MILLION families will go shopping for finished, furnished, decorated factory-built housing this year. A good percentage will be seeking mobile homes. They will find a glut of lower priced merchandise arrayed on some 7,000 sales lots like cars. Better class units will be less plentiful but will be there. If you are in the market for a mobile, how do you make sure you get a good buy?

Decor. Bigger mobile home manufacturers can afford professional designers and decorators. They offer a lot of good styling in low-cost housing. But you should know how to see through the exterior razzle-dazzle and spot the real values.

One way to do that is to stand in the center of a beautifully coordinated living room and visualize it stripped of its draperies, furniture and even carpeting. What you have left is what counts. That is what you will have to work with if and when you redecorate the home yourself. Basically, what counts are sound floors, walls and ceiling, plus quality cabinetry, appliances, and fixtures. All the other is frosting on the cake. These basics you are stuck with for better or for worse.

Another way to check the home is to visualize yourself and your family in it after six months or a year. Will you tire of those black-and-gold drapes, the red Spanish carpet-and-fabric coordination? Will that chair be comfortable six months from now? The master bedroom is planned so that the bed will not belong anywhere else than where you find it displayed.

model airplane engine: see rotary engine, mini

A raised dining terrace is entrancing at first glance but it breaks up the floor level that could allow the living room to appear 10 or 12 feet longer. Where will you locate the TV, the hi-fi and the organ? What about your books, family keepsakes, trophies, collections and whatever? A hardheaded once-over of this kind helps a lot in clearing the course to that comfortable, livable, durable home where the atmosphere grows pleasurably with time.

Marks of quality. Is the wood paneling genuine quarter-inch repairable wood or is it a vinyl print which you dare not scratch? Is the cabinetry hung evenly and will the doors warp now or later? How will the counter top and its corners and edges look a year from now? What kind of warranties come with the appliances and fixtures, the plumbing and heating systems? Is there adequate cabinet and storage space? Is the furniture free standing or mostly built-in—if the latter, how well will you like it a year from now? Ask yourself all these questions.

Construction features. With hand or elbow, push against walls and ceilings. The "feel" or give should indicate to some degree whether the exterior walls have adequate studding and if the paneling itself is flimsy.

More expensive models use regular house-type 2x4 wall studding. True, among high-priced models you will find two- and three-inch walls; but some of these are glued construction of great strength. Ask the dealer if he has a construction chart that shows you Xray views of the construction. Try to determine if the wall studs are dadoed or notched on each edge for lateral girders. A wall stud may be three inches thick, but if a one-inch notch is dadoed out of either edge, that leaves only one inch of vertical strength left in the stud.

Check the little things for workmanship, particularly the drawers. Check their alignment, pull them out and push them in to test the ease of their slide. Run your fingers along the edges for splinters or indications of rough sawing. If drawers are not well built and show signs of poor craftsmanship, chances are the mobile home will have other flaws you cannot see.

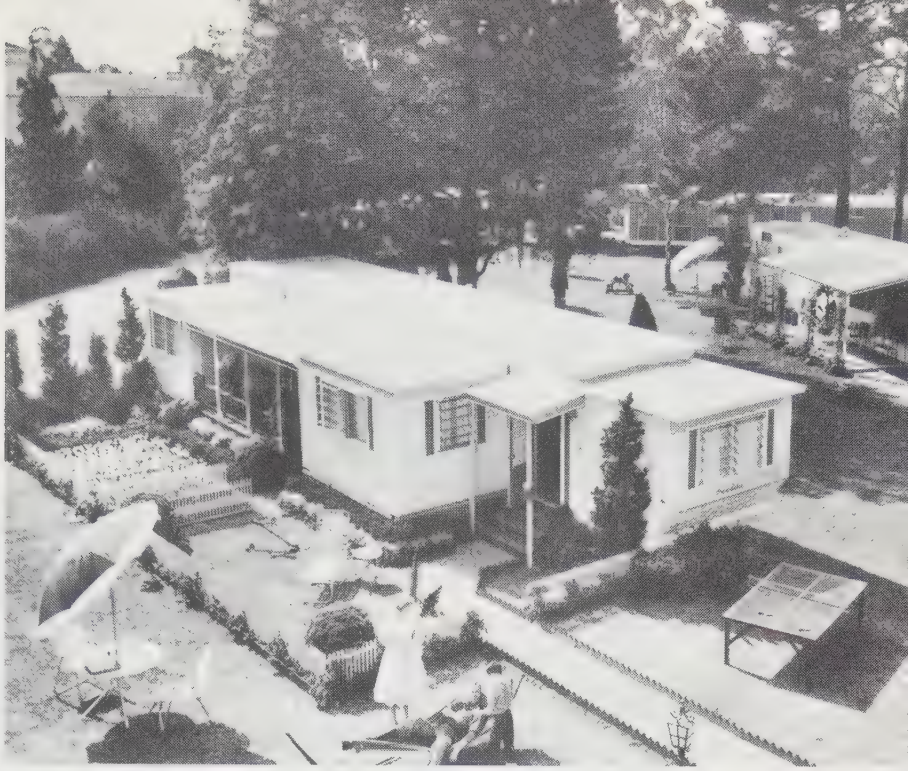
Check all doors (including closet) for alignment, loose construction or warped wood. Interior doors should be at least 1⅜ inches thick, exterior doors should be of metal unless sheltered. Check trim and molding overhead and in corners for fit, and pick at ends and edges to see if they're tight.

Measure the distance between ceiling trusses; if they are more than 16 inches apart, you run the risk of a sagging ceiling. Some mobiles use rows of ceiling rosettes 16 inches apart to make it appear that trusses are on 16-inch centers. Make sure those rafters really are there—from end to end of the unit, not just part way.

Just as you sight along a car to see whether it has had body work, do the same with the mobile home. It may have moved hundreds of miles and somewhere along the way the frame could have been sprung or bent. Closely inspect exterior nailheads or screwheads to find out if they're rustproof. Inspect caulking around windows and doors. Tape-type caulking is better. Caulking that is runny or smeary indicates the work of an amateur.

Take a walk on the roof. If the dealer will not let you, break off the deal right there. A quality roof is truss constructed, steel covered and rigid enough to bear the weight of an average man on every three square feet of space.

New or used? Whether you're smarter to shop for a new or used mobile home depends on a number of factors. Foremost, probably, is the brand. There are more than a thousand factories and each one sports an endless, ever-changing array of brand names and models. Some twenty manufacturers have built enough branch



Where to live in a mobile home? From Alaska to Florida and Mexico, there are parks where you rent a space and sub-divisions where you own your lot. Exterior treatment, such as this, is worthwhile in long-range values.

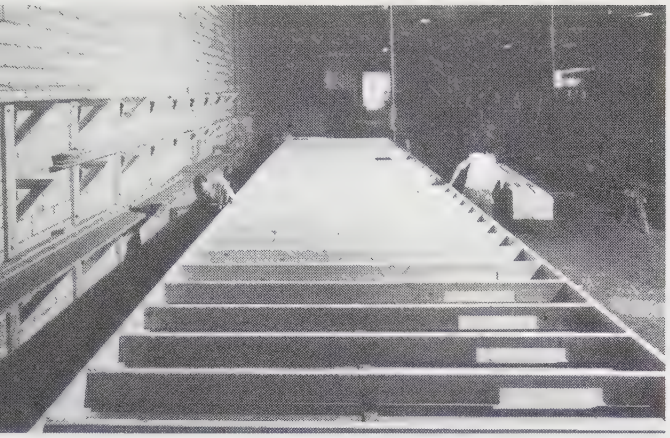
plants to boast, more or less, of national distribution. Their parent names are discernible somewhere on the basic logo that carries this, that, or the other brand name and model designation. It is nothing like buying one of the four American makes of family cars.

If you are thinking of buying a used mobile home ask your banker or finance source to check the official Mobile Home Market Report Blue Book value on the particular model you have in mind. For comparison have him check the value of Brand A versus Brand B, same size, same year. Brand B may list for much more than Brand A. That indicates that Brand B is worth a lot more. A unit that holds a better resale value offers you better basics—better woods, better cabinetry, better construction, better appliances.

Suppose you have checked a brand new 12x60 model of Brand A at $6,000. You have also checked a three-year-old 12x60 model of Brand B priced at $6,000. Do not be bedazzled by the smart decor treatment in Brand A. Look beyond the bright drapes and fabrics and eye-catching bric-a-brac and compare basics. What about the wood paneling, cabinetry, furniture, appliances, and construction? If the three-year-old is superior in these respects, still has solid floors, walls and ceilings, it may be worth more than the new model that costs the same. Visualize the new one two years from now compared to the used one. By that time the used one may have depreciated little more, while the new one may be worth less.

Financing. Most mobiles are financed three to ten years on the same principle used for the financing of automobiles. After your down payment, the finance charges are figured on the balance. That balance is divided by the number of payments set up, and that determines the amount of your monthly payments. Buy a $6,000 model, pay 20% down, and payments, including insurance, might run $84 for 84 months, for example. The dealer is prepared to arrange financing for you if you do not have your own.

Make sure, if your dealer arranges financing, that you review the finance contract, as well as the financial institution or



Sound floors are all-important. In factory, 2 x 12 kiln-dried, knot-free lumber on 18-inch centers insure perfect flooring.

Check all doors of the mobile home you are considering for alignment, loose construction or warped wood. Interior doors such as the one below, should be at least 1 3/8 inches thick; unsheltered exterior doors should be metal. Ask dealer to show you X-ray views of the basic construction. Note additional details in text.

When shopping, press against walls and ceilings. "Feel" should tell something of quality.

bank. Request a copy of your contract and arrange for the proper insurance coverage. Find out whether or not—and under what circumstances—the mobile home can be moved. Dealer, financier and insuror all three will want to know its whereabouts as long as they are involved.

FHA is now permitted to insure loans on mobiles which meet standards as prescribed by the American Standards Institute A-119.1. The term of such loans may not exceed 12 years and 32 days on a maximum loan of $10,000. Such a loan requires a minimum down payment of 5% of the total price up to $6,000 and 10% of the amount over that. FHA will permit inclusion of accessory items, recording fees, taxes, transportation and installation costs as well as certain other insured items.

VA provides for three separate loan limits for mobile home purchasers. They are: 1) $10,000 for a mobile home plus site preparation when the veteran owns his lot, with a term to 12 years; 2) plus $5,000 more to include an underdeveloped lot, with a term to 15 years; and 3) $17,500 for 15 years and 32 days in the case of a loan covering both home and developed lot —but not to exceed $10,000 for the mobile. A recent count showed 130 federally chartered Savings & Loans and 100 state-chartered institutions were making mobile home loans. Check your locality.

Value comparison. Suppose you bought an ordinary $18,500 two-bedroom house with a 20-year FHA mortgage. Spread all of your costs over the 240 months and they add up to something like the accompanying

figures, compared with living in four new $6,000 mobile homes during the same period. Reduce the four mobiles to two and the figure drops to about $160 monthly.

	House Monthly	A New Mobile Home Every 5 Years
Down payment	5.00	6.00
Payment on principal	73.00	53.00
Payment on interest	45.00	15.00
Taxes	15.00	7.00
Insurance	8.00	6.00
Depreciation	31.00	27.00
Maintenance	19.00	3.00
Utilities	31.00	19.00
Furniture depreciation	31.00	20.00
Park space rental or lot purchase		31.00
	258.00	185.00

A professor at Michigan State University figured the comparison in terms of money you could save. If you bought a $16,000 house on 30 years mortgage and were able to accumulate $16,000 during the period, you could have accumulated $25,864 by living in a $195-a-month apartment, or you could have accumulated $38,725 by living in $6,000 mobile homes during the period.

Where to live. Mobile homes pepper the landscape from the Florida keys to Alaska and down to Old Mexico. Most owners have to scout for their own site. For every eight mobiles bought only three spaces are available in parks. The rest locate on lots in towns or villages where zoning laws permit, or in most cases out in the countryside or in a leisure home spot. If you live in the midwest, you will find half the mobiles out on the farm, where city workers rent or buy a lot from a farmer, or the farmer buys mobiles for himself, his relatives, his tenants, or for rentals.

There are mobile home parks, where you rent a space, and there are mobile home subdivisions, where you own your lot.

Ideally, parks come in different varieties. First there is the service park, where the elderly or retired especially find a community life available through management services. This is something like "open air" apartment living. Second, there are community housing parks which accommodate the largest number of units and provide all the features usually found in a subdivision. Third, there are resort parks where any of these luxury features are provided—club houses, tennis courts, boating, even golf courses.

But sadly most parks do not meet these ideal descriptions. The overwhelming majority are little better than parking spaces for house trailers. In some, units are stacked almost wall to wall. In others, where congestion does not exceed the comfortable norm of seven to the acre, the mobiles are simply propped unskirted and unrelieved by exterior accessories.

Individual homes on private lots rarely look any better. No manufacturer has ever devised a skirting system to go with the mobile, few park operators require skirting in their parks, and few private owners bother.

But given a chance, the average mobile can be made to look as attractive and appealing as any other kind of housing. For an extra thousand dollars worth of exterior attractions (included in your original purchase and financed as part of the package) you can do wonders with the exterior—skirting, porch, steps, awning. For two thousand dollars you can work a miracle. And in long-range values the exterior treatment is worth it: lawn, shrubs, flowers, walkways, carport, sideroom, fencing and the like will help hold up the value of your investment and allow it to appreciate instead of depreciate. M.C.

See also: CAMPERS.

➤ *Slum-like trailer parks are becoming less frequent, as is evidenced by this mobile dwelling unit with garden and backyard patio.*

Choosing a Site for Your Mobile Home

Yesterday's slum-like mobile home parks are becoming rarer as better planned, almost suburban sites increase

MORE PEOPLE THAN EVER before are considering mobile homes as a solution to their housing needs. But finding the home you can afford isn't the final solution to your housing problems. You still have to find a desirable setting for it. And this—in some areas—can take more time than you spent in selecting the mobile home itself.

The old picture conjured up at the mention of trailer park—several shiny metal boxes clustered close together—is fast becoming obsolete. Today, thousands of mobile homes are being located on well-developed and landscaped parks or even on individual lots.

Throughout this country more parks are being built to meet the demands of an ever growing consumer-wise public. In some areas mobile home sub-divisions are springing up where you can buy a lot and house together.

Atlanta, Georgia—a rapid growth metropolis with accompanying housing needs—is typical of many sections of this country. More than 1.5-million people live somewhere within a 40-mile radius of downtown Peachtree Street in Atlanta. Housing is scarce of course. Rent is high. The result—myriads of families are shopping for mobiles.

In a survey of 40 mobile home parks within the 40-mile orbit of "Greater Atlanta," four new major mobile developments recently were found to be opening up twice as many new park spaces as all 36 older parks had developed in the last two decades. Before 1968, 36 parks were filled up with 3,716 mobiles jam-packed like sardines. Since then, four new developments had expanded the number of spaces to 6,666 with plans to reach a total of 9,900 spaces—3,200 of these new lots can be bought and owned as part of the home

Landscaped grounds, clean streets and carefully designed layouts have decreased community resistance to trailer parks in some areas.

purchase price. Meanwhile more developments are opening.

About a thousand new parks are said to be opening every year.

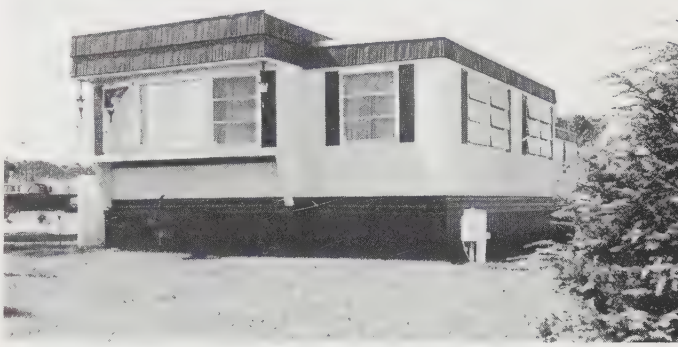
But parks are far from being the only places where you can site a mobile. Think of this: 450,000 mobiles are expected to be built in one year; yet only about 125,000 new park spaces are hoped for.

That leaves 325,000 mobiles stranded outside parks. (We assume that old 10-20-year-old mobiles and slum parks are being scrapped at about the same ratio.) So where are a third of a million new mobiles going?

Do not let the prospect discourage you. First, the figures we quote here, like most industry "research," are full of holes. One professor in Pennsylvania found three times more parks in that state than the 125,000 mentioned earlier. And the chances that the professor found them all are remote.

For one thing, not all parks are listed by anyone. Some of them start out as clusters of two or more, then keep growing up to 10, 20, 30—who knows how many more? The cluster becomes a "park." It takes no name. It just becomes "That mobile home park out on Road X."

Besides parks, named or unnamed, there are the singles and doubles you see scattered everywhere, just like any other kind of housing, inside corporate communities, out in the countryside, up in the hills, down on the lake—everywhere that local codes allow. Drive out in the countryside sometime and count them. Or if you ever fly low in a plane, just look down and you will see



Looking at the front of this dwelling, you would guess with difficulty that it is a mobile living unit. The addition of roof trim, shutters and paneled skirting makes it look something like a house.

Developers of mobile dwelling sites are taking more care in planning their parks and lots, frequently hiring architects and planners to do the job for that professional look.

them. As you see them, draw them together with your eyes and imagine how many parks they would fill.

In prairie stretches like Illinois it is known that half of the mobiles are on farms. A farmer sites a cluster of mobiles to rent or lease or sell. He houses his retired parents, his married son, his tenants or himself in mobiles.

More and more mobiles end up on vacation or second-home sites. A lot of people own a winter mobile in Florida or Southern California, while living most of the year in another mobile up north or somewhere inland.

This is just a scant review of some of the places where mobiles are going. But it is enough to indicate that where there is a will to own a mobile there is generally a place to be found to put it.

Of course this cannot be true of every place. There are communities, counties, even states that would rather drop dead under the crush of a houseless population than to allow mobiles. True, they may be unreasonable and extreme; but look at the reasons that drove some of them to outlaw mobiles: park developers in the past, in their lust for the easy quick buck, disgraced the landscape with slum trailer parks. Individuals on their own lots propped mobiles up on cinderblocks, ugly, unskirted—tincan versions of Tobacco Road. Of course the solution is to lay down sensible restrictions and requirements that allow mobiles on lots or in parks so long as they are made attractive like other housing. Most communities are taking this route.

Anyway, suppose you would buy a mobile if you could find a desirable setting. How do you go about finding one? These suggestions may help:

Find out from mobile home dealers or from the local mobile home association what the park situation is in your area.

Generally the best park setting is one in which the park does not pretend to offer more than attractive suburban atmosphere. That means good average community roads and streets, utilities, adequate community management—just what you would expect in the average nice housing development. Some parks tout lavish community centers, swimming pools, tennis courts, even a golf course. Fine, if you can get it. But practically speaking, don't you think it is a bit silly, not to say extravagant, to have to join a high class country club just to live in a $6,000-to-$16,000 mobile home?

If park spaces are available, you may or may not find strings attached. For instance, if a dealer is developing the park himself, he naturally expects you to buy your mobile from him. That only makes sense. If his price and his space rental are reasonable and you like the package, why not?

Or maybe you go shopping through the yellow pages for a rental space among the parks. You either 1) find none available, 2) wind up on waiting lists, or 3) you find spaces. After you see them you may not want them.

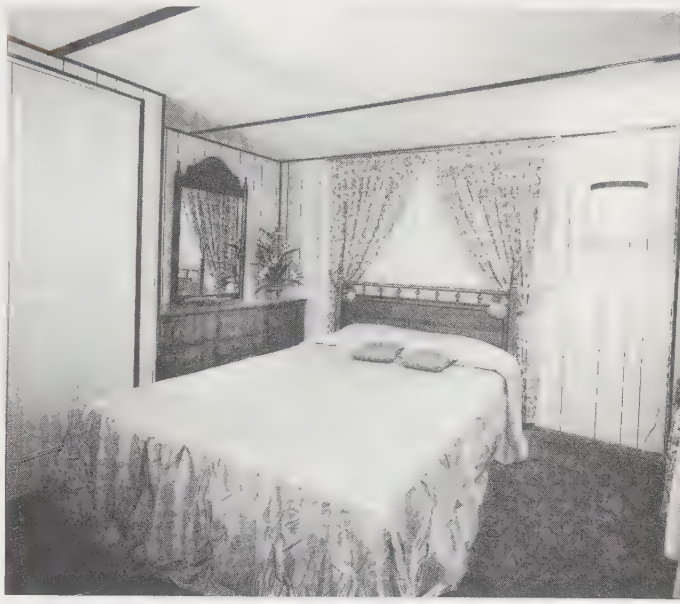
Anyway, if you cannot locate in a park, if a dealer cannot help you, and nobody else can either, then you might try shopping for a lot to rent or to buy out in the countryside. How? One way is to spend a weekend driving around asking landowners. Inquire at village stores and post offices. Advertise in farm papers or country weeklies.

Of course if you find your own lot, whether you buy or rent, there is the matter of water, plumbing, fuel and lights. Do not get stuck on some hasty deal before you find out what improvements are going to cost and how you are going to foot the bill. If the whole idea sounds sticky, remember: a third of a million families must be finding it less sticky to locate a place for a mobile than to find any other form of housing. M.C.

See also: CAMPERS.

Self-defense for the Mobile Home Buyer

Spoken promises and brochure generalities don't mean a thing. If you can't get specifications and guarantees in writing and you can't check something out yourself, find a better dealer



WHEN YOU BUY a conventional house, the real estate agent may not stand behind the product, but the builder himself is usually nearby and on call. However, when you buy a mobile home the builder may be hundreds of miles away and it is the dealer himself who is supposed to stand behind you on service.

The dealer delivers your dwelling, sites it, hooks up the utilities and, supposedly, checks out the wiring, heating and plumbing before he hands the keys to you. He is supposed to have gone over the home thoroughly, the way a car dealer is supposed to have serviced a new car thoroughly before he sells it. Windows and doors are supposed to hang and function properly, floors, walls, ceiling, appliances, furniture, water and plumbing lines—everything is supposed to be in top condition.

Later, if a panel pops or a tile buckles or the ceiling leaks—no matter what

PREBUILT DWELLING QUALITY CHECK LIST

Check the "Specifications" list on the literature of the unit you're inspecting. If the literature avoids such a list, offering nothing but flowery products blurbs, beware. If it does offer a list but deals in generalities ["Quality woods for walls and trims" instead of specific thickness and kind; "Name brand appliances" instead of sizes, dimensions, features, etc.] then you can suspect the unit of having something to hide.

SOME FEATURES TO CHECK CAREFULLY	TYPICAL INFERIOR SPECIFICATIONS	QUALITY SPECIFICATIONS
ROOF		
Rafters	24″ on center throughout or part way	16″ on center throughout, 6″ to 8″ trusses
Insulation board	No	Yes
Vapor barrier	No	Yes
Insulation	1″	2″
Ceiling material	1/2-inch 4x12 sheets/rosettes	Panels, no rosettes
Ceiling height	7′ to 7 1/2′	8′ throughout
WALLS		
Thickness	2″ to 3″ dadoed and nailed	3″ to 4″ glued, nailed or both
Centers	16″ part way or 24″ all the way	16″ throughout
Insulation	1″	2″
Vapor barrier	No	Yes
FLOOR		
Construction	8″ steel chassis 2x4 or 2x6 floor 1/2-inch particle subfloor	10″ to 12″ I-beam 6″ to 8″ floor 5/8″ to 3/4″ plywood subfloor T & G or shiplap
Insulation	1″ strip	2″ blanket
Undersealed chassis	No	Yes
Tile	1/8-inch roll goods	Cushioned
Carpet	Thin jute or foam backing	Padded
HEATING SYSTEM		
Gun Furnace	No	Yes
Ducts	Minimum for heat	Adequate for central air conditioning
WOODS		
Closet liners	5/32″ to 3/16″ vinyl print Pressboard	1/2-inch natural wood
CABINETRY		
Doors	Flakeboard	Natural wood
Hinges	Non-spring	Solid wood [non-warp]
Trim	?	Spring [self-closing] Molded, mitered

SOME FEATURES TO CHECK CAREFULLY	TYPICAL INFERIOR SPECIFICATIONS	QUALITY SPECIFICATIONS
DOORS		
Exterior	Aluminum, min. dimensions	House-type with screen & storm
Interior	Sliding	Hinged
Closet	Sliding or metal bifolds	Wood bifolds
CLOSETS	Unlighted, pressboard lining, skimpy shelves and rods	Lighted, woodlined, sturdy shelving and rods, carpeted
MIRRORS	Unframed, clipped	Framed, well lighted
DRAPERIES	Window length	Full length, lined, underdrapes
FURNITURE	Built-ins	Free standing
Sofa, chairs	Flimsy	Solid, comfortable
Dinette	Metal print	Wood
Beds	3/4 to standard box spring	Standard to king, Innerspring, headboards
APPLIANCES		
Refrigerator	12 cu. ft. single door	14+ cu. ft. double door
Range	24″ to 30″ standard	30+inch deluxe, eyelevel oven
Water heater	17 gal.	30 gal. 220V double element

shows up as a faulty product through no fault of yours—the dealer is supposed to service your home.

But promises made during the time of sales are sometimes purely political promises. By the time you assume occupancy and the light socket goes dead many a dealer has marked you off his list.

Manufacturer's reliability. Ordinarily in buying a house you contact the builder and check him out for reliability before you sign the contract with his agent. This is not so easy when you are buying a house manufactured in some distant factory. But it is not unreasonable to request some kind of confirmation, written if possible, that your home has been adequately inspected by the manufacturer before release to the dealer. Request the dealer to produce for you—if he does not have it—a manufacturer's checkout report certifying that the unit was sound and functioning when it left the factory. A reputable manufacturer will include with the home an inspection checkout certificate signed by an authorized plant inspector similar to the certificate shown here.

Dealer's certification. Your dealer should also furnish you his own Make-Ready and Service Report certification before you accept the home, stipulating that he has gone over the unit on such details as listed in the accompanying certificate.

Warranties. You should receive from the dealer, as part of the closing agreement, several documents such as serial number, insurance papers, contract, etc. Important among these are your manufacturer's warranty and suppliers warranties covering appliances, materials and the like. Go over

DEALER'S MAKE-READY AND SERVICE CERTIFICATE

The reputable dealer will furnish you a service report on the home he sells and installs for you, signed by his authorized service representative, at the time you assume ownership and occupancy. This certification should cover such check-outs as the following:

EXTERIOR
___Finish
___Material
___Roof ___Leaks
___Drip rail ___Caps
___Vent lines
___Doors ___Locks
___Door install.
___Windows ___Install.
___Screens ___Storms
___Coupler ___Steps

EQUIPMENT
___Carpeting ___Install.
___Tile ___Install.
___Paneling ___Accents
___Pictures ___Plcmt
___Finish ___Molding
___Cabinets ___Drawers
___Wardrobes ___Hardware
Doors ___Hinged ___Sldg
___Blinds ___Drapes
___Curtains ___Lights
___Fans ___Tables
___Lamps ___Beds
___Couch ___Chairs
___Dec. Kit
___Mirrors ___Plcmt

UTILITIES
___Furnace
___Water heater
Make_____
Model_____
___Oven
Make_____
Model_____
___Refrigerator
Make_____
Model_____
___Washer
Make_____
Model_____
___Dryer
Make_____
Model_____
___Other
Make_____
Model_____
___Heat ducts ___Exhaust ducts
___Ventilators

PLUMBING
___Shower ___Curtain/Doors
___Toilet:
Make_____
___Lav. ___Tub ___Knobs
___Sinks

RUNNING GEAR
___Axles, Wheels, etc.

Make_____ DEALER_____

Model_____ SERVICE REPR._____

All plumbing should be tested for proper flow and possible leaks around joints.

All equipment such as carpets, pictures, lamps, etc. should be as requested.

MANUFACTURER'S CHECK-OUT CERTIFICATE

A reputable housing manufacturer will furnish certification that the home you purchase has been inspected before leaving the plant. The certification, signed by an authorized company inspector, should specify that the unit has been checked and okayed in such areas as the following:

EXTERIOR
___Metal application
___Window application

ROOF
___Sealer
___Over-all condition
___Leaks ___Caps
___Drip rail ___Vents

PLUMBING
___Drain line [water check]
___Antifreeze
___Tubing [air check]
___Pipe/Joint install.
___Plumbing panel install.

HEATING
___Furnace operable
___Registers
___Gas pipe/Tubing
___Flues ___Ducts
___Volometer reading

FLOOR
___Covering install.
___Carpeting install.

ELECTRICAL
___Recepts. & switches
___P54 box ___110 volt
___1000 volt ___Gd. wires
___Lights ___Fans

OPENINGS
___Doors ___Screens
___Windows ___Storms
___Cranks ___Screws
___Chimes ___Sldg doors
___Shower curtain
___Sliding door screws

GENERAL
Check securing of ___Drawers
___Doors ___Lights ___Accent
___Paneling ___Furniture
___Tile ___Finish
___Molding ___Drapes ___Curtains
___Beds ___Cabinets ___Counters
___Couch ___Tables ___Chairs
___Wardrobes ___Steps
___Mirrors/screws ___Pictures/screws

CLEANUP
___Sweeping ___Mopping ___Vacuum
___Drawers ___Counters ___Sinks
___Lavs. ___Plastic off carpet
___Closet, cabinet interiors
___Heat/cold ducts ___Mirrors
___Registers screwed to floor
___Plumbing panel install.
___Carpet covering ___Other

MODEL_____

SERIAL_____

INSPECTOR_____

Date

▲ *Utilities such as the oven should all be connected and working before moving in.*

these documents thoroughly with the dealer.

Owner's manual. The material you receive should include a home owner's manual. Study it and carry out your share of responsibilities in caring for your home. The validity of your service claims and all your warranties depend heavily upon your doing your part thoroughly and intelligently. Do not allow yourself to be caught pleading ignorance on any point. Besides, the good condition, satisfactory service and long life of your home depends largely upon you. M.C.

See also: CAMPERS.

Finishing the "Finished" Mobile Home

When manufacturers claim these towable shelters are finished, they really mean just the interiors. Additions such as awnings, porches, canopies, carports, fences and steps are your responsibility, but they can do wonders for the exteriors

THE MOBILE HOME can look as beautiful as any other home. That is, when it is finished on the outside. With the right accessories, the mobile home becomes a neat and attractive asset to both its owner and the community. But the mobile home seldom gets the full exterior treatment. The poor mobile falls victim to a delusion. The delusion that—according to its manufacturer—it comes complete and finished.

It may be finished inside, but the outside is all yours. Certainly the manufacturer assures the dealer that "all that's lacking is the linens and silverware." The manufacturer may feel that he has performed magnificently if he has added shutters or imitation shutters to doors and windows. But what about skirting to hide axles and hitch and ugly black undercarriage? What about window and door awnings, stoop, steps, porch, patio, carport, sideroom, storage house, fencing—all the exterior finishings that go to fill in the image of the attractively finished home?

The manufacturer simply feels that these are "accessory" trappings not in his province. If anybody is to look after this for you, it will have to be the dealer.

But you, the buyer, may end up with an unfinished home. Few dealers will even offer to include exterior finishings in the package price—unless you insist. The average dealer is perfectly willing to deliver your unfinished home and set it up on your lot, or even in an otherwise attractive park, and leave it roosting on concrete block stilts.

If you let this happen, you may never

get your manufactured home finished. The reason is simple. Your mobile home needs from $1000 to $2000 in exterior "accessories" before it ever looks decently finished. If you can include those items in the original purchase contract then it becomes a matter of adding a few more dollars to your monthly payment. But if you buy and install them later, the cost is generally higher and the terms shorter.

Even with these additions you still get a bargain. A completely packaged home can be had for under $10,000 up to (excepting very deluxe models) not more than $16,000. This includes two and three bedrooms and two baths.

As for attractiveness, your manufactured home can look as nice in its own right as a house. To prove it, two mobile houses were decorated at a trailer park near Atlanta, Ga. One home had a pull-out sideroom. The other was a T-shaped modular (by "modular" is here meant, in simplified terms, one mobile unit joined into the side of another mobile unit).

An Atlanta company specializing in community designing, planned the designs. For the first, the designer selected a full complement of exterior finishings.

The completed home sported window and door awnings, porches, patio, carport, flowerbox and storage house. The roof trim in the home was picked up in the fascia trim of the patio and carport covers to accent and elongate the design into rambling dimensions. The finished design increased the retail price of the home about $1,000.

Similar accessories were selected for the T-ranch modular. Due to its rambling shape the designer found more latitude for architectural expression. On the rear side, overlooking a lake, he added a screen room. The full exterior treatment upped the retail price approximately $1500.

▲ Before: *Rambling shape of modular unit allows for more latitude in architectural expression and lends itself to more creativity in final dress up.*

◀ After: *Direction of carport extends depth of modular structure. Also included is a rear screen porch, not shown.*

The question is, of course: Do outside finishings price the manufactured home out of the market?

"No," says one developer. "People now come to buy these homes who wouldn't even look at them before."

True, both homes are now out of reach of some prospective buyers. But they are now acceptable to many more buyers than ever. Unfinished, they had appeal to about 15 percent of all home buyers. Now they draw serious attention from at least twice that many more.

Look at it this way. Say yours is one of the next 100 families who will buy a home in your community. Eighty-five families are visualizing a conventional house. Fifteen are visualizing a mobile or modular. Those 15 are reconciled to the prospects of living in a 12-foot-wide box set on concrete piers. But would the other 85 ever remotely entertain such a thought? Never.

What happens, however, when all 100 families are shown a mobile or modular dressed up like these in our demonstration? What, for example, is your personal reaction? Whether or not you would still consider a mobile or modular, you can readily see why others would.

In some parts of the country, Florida for instance, many mobiles are finished on the outside before being offered for sale. In other areas the better parks require that all units at least be skirted.

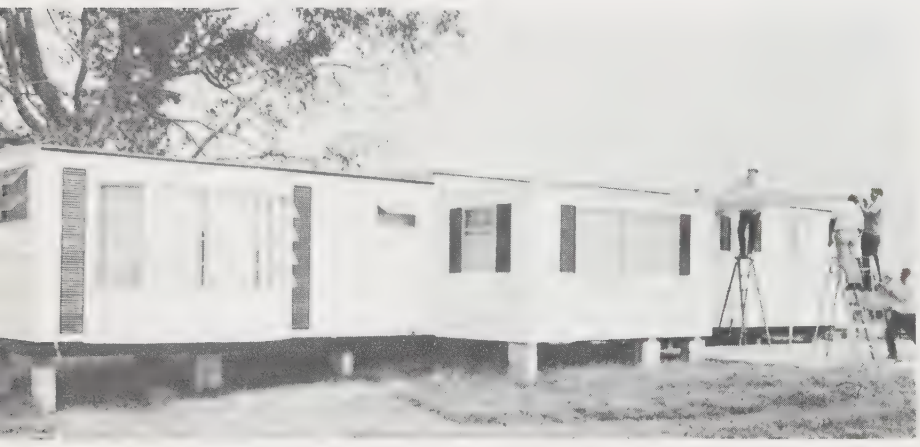
One strong argument for finished exteriors being heard nowadays is, "Couldn't the local code makers solve a lot of housing problems by simply requiring that mobile homes be finished on the outside?"

By "finished" these proponents mean: A minimum treatment of at least skirting and attractive steps—plus a minimum of one or more improvements such as awnings, porches, patios, carports, siderooms, storage housing, fencing and the like.

If this simple criterion were adopted and enforced, it is argued, then the mobile home ought to be allowed to be sited on any property, inside or outside a park, wherever the owner can afford the price of the land. It would then find its own economic environment somewhere between the slums and snob hill. As for the chronic bugaboo that such a dwelling would downgrade adjoining real estate, it has been explored in study after study by authorities.

Such housing qualifies, mainly through FHA, VA and Savings & Loan Associations, for long-term (10 to 20 years) financing in many parts of the country. Exterior finishings are certainly as eligible for package financing as interior furnishings such as refrigerators, beds and sofas.

The accompanying chart represents typ-



Even though manufacturers claim that the mobile home is finished, they really mean only the interior. On this home you can see that there was no skirting included in the package. Workmen will eventually install a carport, back porch, full-round-the-home skirting and dress up the trim.

ical payment rates figured at 6% on amount borrowed plus 1% a year for credit life insurance, an effective annual percentage rate of 11.99% to 12.91% depending on terms.

Exterior finishing costs will vary but these estimates are fairly typical.

Assume that you are buying a mobile home and will arrange to finance $5,000 of the contract for a period of eight years (terms range from 7 to 15 years depending on local circumstances). But you want the exterior finished by the dealer, the cost of all exterior finishings (installed) figured as part of your original contract.

If the representative package of exterior finishings listed and shown here cost $1,000 installed and you add this to the basic home contract of $5,000, this makes $6,000 to be financed.

Your monthly payments would be (in this typical case) $81.25 for eight years on the basic home amount of $5,000. The added $1,000 ups your monthly payments by $16.25 to a total monthly payment of $97.40.

But look what happens if you do not add the exterior finishings into the original contract. If later you add $1,000 in exterior finishings, you would have a hard time getting the $1,000 in home improvements financed for longer than four years. At the same interest and insurance rates your payments would now run $26.67 monthly for the home improvements alone. Your house payments of $81.25 plus your home improvements payments of $26.67 would total $107.92.

This homeowner has installed a porch and car covering, furnished the porch and planted grass and shrubs. It is difficult from this angle to tell this mobile unit from a house.

As for the buyers of manufactured homes, developers agree: "They want their homes finished outside as well as inside."

So, if you are considering buying a mobile or modular, keep this thought in mind: It does not come finished. You can have the exterior finishings included and installed as part of the original sales price. Unless you do this, it will be harder and costlier to finish the exterior later. M.C.

See also: CAMPERS.

TYPICAL PAYMENT RATES

	Amount financed			Monthly Payment 8 years [96 Mos.]
Furnished Mobile Home	$5,000			$81.25
Exterior Finishings Installed	1,000	Skirting	$300.00	16.25
		6 Window Awnings	100.00	
		2 Door Canopies	50.00	
		Patio Cover	215.00	
		Carport	225.00	
		Lawn Building	110.00	
TOTAL	$6,000			$97.40

Build a Hideaway Track for Your Model Cars

When storage space for your track is limited, solve the problem with a layout that folds or rolls out of sight

PROBABLY EVERY MODEL racing car fan would like to have a permanent layout at home. It's great to be able to race any time you wish, without having to set up and dismantle your trackage, accessories and scenic effects for every session. Furthermore, having the model racing track permanently mounted automatically prevents the damage and distortion that in time almost inevitably attend putting track sections together and taking them apart again. Yet a great many racing fans do not have the space to allow a layout to be set up permanently.

The answer is to construct a disappearing or hideaway layout, a system permanently mounted and wired that folds up into a wall or piece of furniture, or slides out of sight when not in use. There is almost no limit to what can be accomplished in designing and constructing such a set-up other than your own ingenuity and skill. Such layouts may be simple and merely serviceable; they may also evolve into a first-class job of furniture building and cabinetmaking, resulting in a unit that will add to any room in the house. Several materials are available at most lumber yards and building supply houses that go a long way toward making the task easier and the result more attractive.

Before proceeding to specific ideas for hideaway layouts it would be well to discuss these materials, their advantages, for they are ideal for permanent model raceway systems as well as the disappearing kind. While the amount of materials used in the average layout is small, you can save by knowing types and grades.

Plywood. A laminated wood supplied in sheet form, usually made of three or five thin plies bonded together. Since details of the types are included here we'll limit our comments. The finest quality interior plywood is five-ply with both sides made of top-grade wood without knotholes or defects. Its great usefulness comes when both sides are to be visible. Plywood of this type, involves considerable weight.

There are times when it is desirable to have both sides of the baseboard of a hideaway model racing layout showing: one side when the layout is hinged up, the other side the surface of the layout when in use. However, in such instances, due to the weight of the heavy plywood, as well as to conceal wiring, it is better to use the double panel construction described later.

For general construction where only one side of the wood is to show as the exterior of a piece of furniture concealing a hideaway layout, the next best grade of interior plywood may be used.

Plywood customarily comes in standard sheets or panels 4 x 8 feet, 4 x 6 feet and

modern desk: see furniture, indoor
modern workbench: see workbench
modular entertainment center: see furniture, indoor
modular laundry center: see laundry rooms
molding, cove base: see floors, tiling

so on. If you can plan your project so as to make use of a standard panel or multiples (for a hideaway layout a single panel almost always is sufficient) it will be to your advantage both in terms of money and work. Because of its laminated construction, with the grains of the different layers running at right angles to each other, it is not easy to cut plywood with a handsaw. In fact, if you require an odd-size panel, it would probably be a good idea to have the supplier cut it.

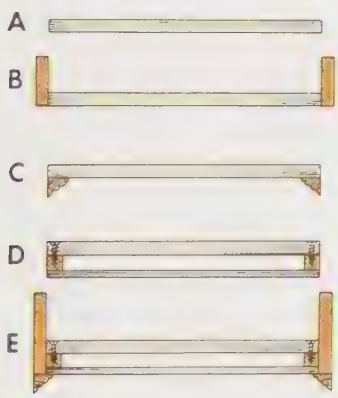
The most expensive grade of plywood is exterior plywood, although this often is used indoors. It is the best material of all plywoods and worthy of consideration for a first-class model racing layout job but it is a little more costly than the interior grades.

Homasote. Another material that will commend itself to the model raceway layout builder. This is a wood-fiber building board used for a wide variety of purposes. It is available in standard size sheets, usually in multiples of four feet, such as 4 x 4 feet, 4 x 6 feet, 4 x 7 feet, 8 x 5 feet, 8 x 7 feet, and so on. The usual thicknesses are $^{15}/_{32}$-inch and $^{5}/_{8}$-inch; the $^{15}/_{32}$-inch grade should do most raceway jobs.

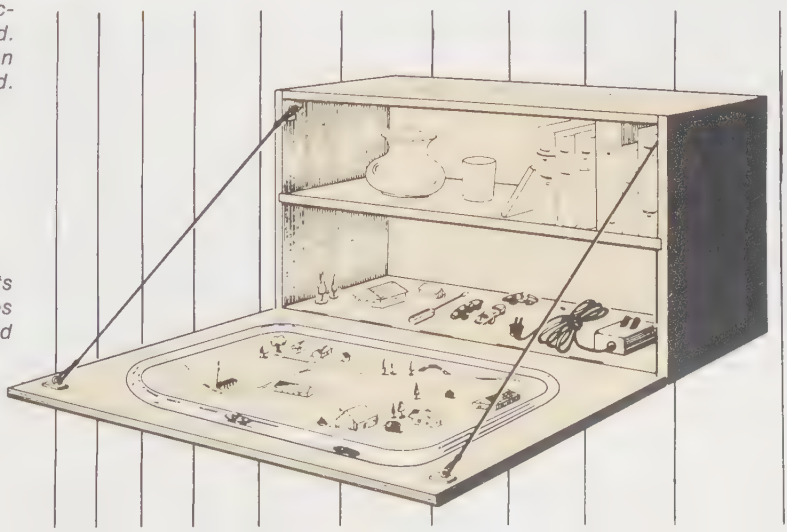
Homasote is easy to handle and seems to have several advantages. For one thing, it absorbs sound. It is easier to drive nails and screws into Homasote than into laminated wood. Lastly, Homasote has a slight surface texture; when painted with a thin coat of green paint the result is a fairly creditable grass effect (although some hobbyists still prefer to use a grass mat regardless of the material under it).

Wall panels. The hobbyist who has some knowledge of modern materials is likely to consider pre-finished decorative panels for a hideaway layout. They are very attractive, usually finished in colors and grains of popular woods. There are two main types. One is made of plywood and the other hardboard. They are finished on one side only and usually grooved at random intervals to simulate a paneled wall of random width lumber.

In constructing a hideaway layout as part of a piece of furniture these pre-finished panels often can be brought into play to provide an attractive external appearance. As they customarily are available only in ¼-inch thickness, however, it is inadvisable to use them as both the



End views of construction methods discussed. D and E are best when double board rig is used.



Besides sash weights and their chains, cables should be used to hold such suspended units.

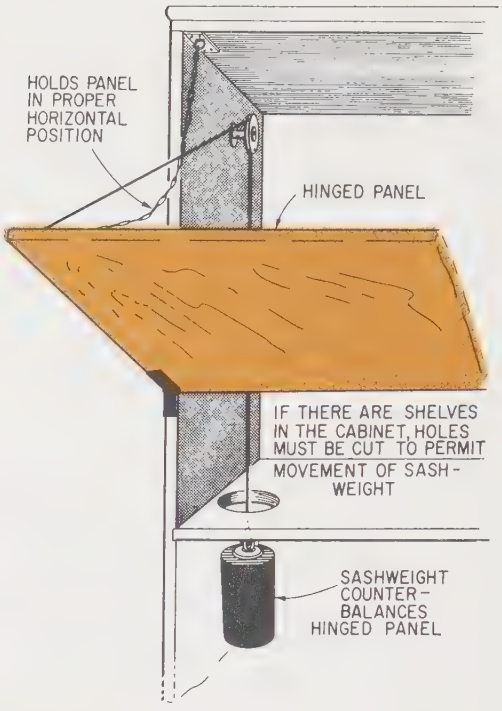
decorative front and actual mounting board for tracks. The best construction is that shown in the accompanying drawing where a double board is employed.

Even a ¼-inch panel will have sufficient strength to support the trackage and accessories of a typical hideaway model racing layout. The problem is that ¼-inch does not allow much depth for screws or nails to hold to the board without fastening devices showing through and without danger of splitting the outer surface and spoiling its decorative effect.

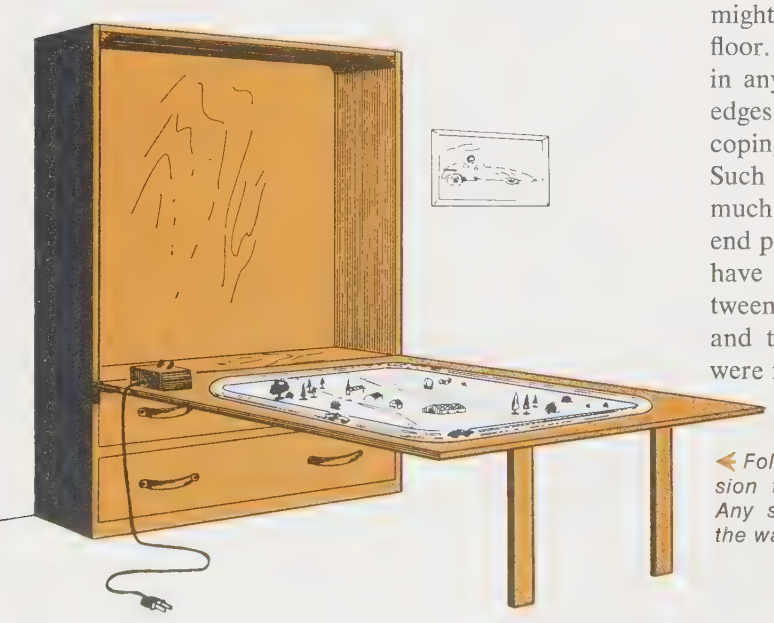
When a layout includes only wiring to the power pack and controllers this is no particular problem; the wires can be laid on the surface of the board. However, when a more finished layout, with scenery and lighted accessories—lamp posts, illuminated buildings and possibly others—is desired, the realism is impaired when numerous wires are run across the board's exposed surface. In such cases, double-board construction is highly desirable. All the wiring is run between the two boards and short lengths of wire emerge through holes drilled in the board only where they connect to accessories.

Should the hideaway layout have a coping or guard rail around it to prevent cars from falling to the floor? Such a coping is desirable, but not always practical on a hideaway layout.

The book and ornament shelf illustrated might be employed with the folding leg construction, just as the hanging shelf idea might be built into a unit that stands on the floor. However, if a coping were employed in any arrangement with shelves, the shelf edges would have to be cut to receive the coping when the layout was closed up. Such cuts might weaken the shelves so much that they could not be mounted to the end pieces of the cabinet. But spaces would have to be left to receive the coping between the actual end pieces of the cabinet and the false walls on which the shelves were mounted.


HOLDS PANEL IN PROPER HORIZONTAL POSITION
HINGED PANEL
IF THERE ARE SHELVES IN THE CABINET, HOLES MUST BE CUT TO PERMIT MOVEMENT OF SASH-WEIGHT
SASHWEIGHT COUNTER-BALANCES HINGED PANEL

Sash weight arrangement is insurance against panel falling suddenly and also eases raising and lowering. Such an arrangement is suggested even when using legs.

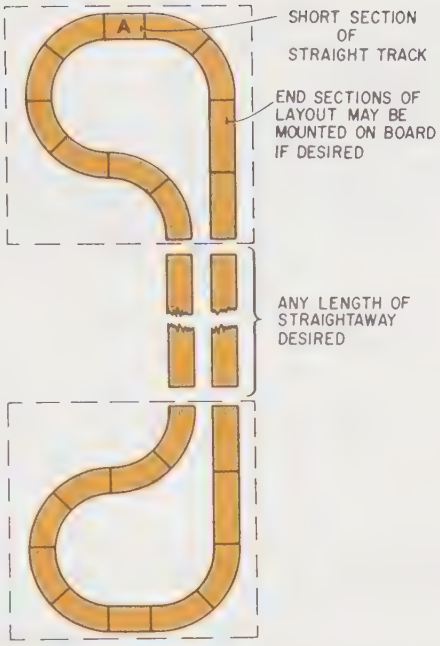


Folding legs are sturdier than cable-suspension table but may detract from appearance. Any such units must be fastened securely to the wall studs.

Types of layout boards. When copings or moldings are employed, the coping or molding would also extend along the front of the board but these have been omitted in the drawing for the sake of clarity. In all cases the board on which the track itself is laid is intended to be plywood, Homasote or similar material. When the double board construction is used, the outer board may be plywood or one of the pre-finished panels.

When double board construction is used, the upper or layout board is secured to the spacers or stringers (¾-inch or 1-inch square stock) by screws so that the upper board may be removed for access to the wiring between the two boards.

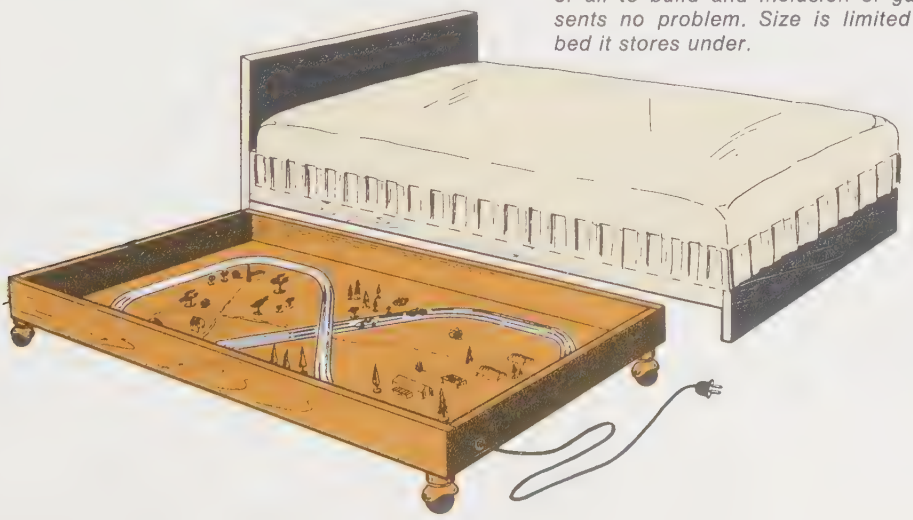
The best thickness for the mounting board itself will vary according to the precise construction used. The $^{15}/_{32}$-inch Homasote will be suitable whenever this material is used. For single board plywood construction the ⅜-inch thick would probably prove the most suitable. It should be rigid enough for even the largest layout of this type and have enough depth to receive the nails or screws that hold the track without risk of splitting or having the points come through. Heavier plywood would add nothing further but useless weight. When double board construction is employed, the same Homasote would be used but ¼-inch thick plywood would be sufficient for the track board. The outer board would be either ¼-inch plywood or ¼-inch prefinished panel stock.

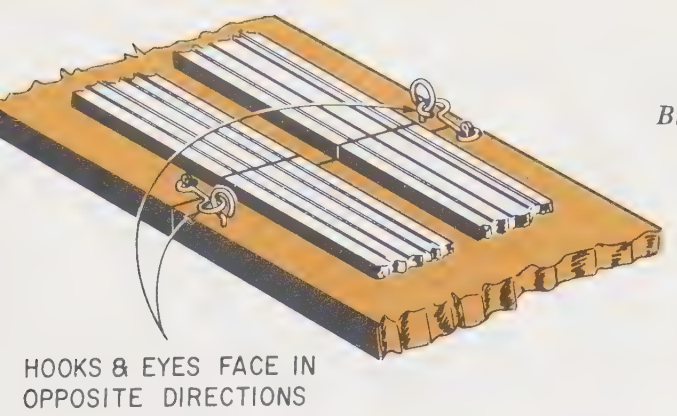

A
SHORT SECTION OF STRAIGHT TRACK
END SECTIONS OF LAYOUT MAY BE MOUNTED ON BOARD IF DESIRED
ANY LENGTH OF STRAIGHTAWAY DESIRED

▲ *One possible layout other than conventional oval or figure 8. End sections are mirror images of one another. Straightaway need not be all straight. It can be L- or U-shaped.*

Safety precautions. Regardless of materials and constructions selected, any of these layouts would make a very heavy load if the folding panel dropped suddenly. It is advisable, therefore, to secure the panel in the closed position with two strong latches. The preferred method, especially when there are small children

▼ *Castered under-bed unit is, perhaps, easiest of all to build and inclusion of guard rail presents no problem. Size is limited only by the bed it stores under.*





▲ *Connecting sections of mounted track will be held firmly by hooks and eyes. Electrical connections will be regular track connectors.*

around, would be to employ a lock that opens with a key in place of one of the latches. Installing a sash weight arrangement would not only serve as additional insurance against the panel falling suddenly when released, but also would make the lowering and raising of the panel considerably easier. For both these reasons, the addition of such a system should be considered even when the lowered surface is supported by legs.

A sash weight with suitable cable or sash chain should be installed at each end of the layout. Experience has shown that while the idea may be good in theory, it is virtually impossible in practice to arrange the sash weights so they will balance the layout panel in a perfectly horizontal position. Accordingly, in entirely suspended layouts, the regular cables that hold the layout in operating position should be used in addition to the sash weights and their cables. In no case should cord or twine be used to hold suspended layouts of this type. Cable or sash chain always should be employed.

Folding legs will provide sturdier construction than the cable-suspended table but may detract materially from the appearance when the layout is hidden away in the cabinet. This is a matter of personal preference. Most model racing equipment is comparatively light in weight—track, cars, buildings, scenery—and will not add materially to the weight of the panel. The heaviest article is the power pack itself, and it may be mounted inside the cabinet if desired, not on the folding panel itself.

Wall-mounted layouts. Make sure wall-mounted unit is secured firmly to the wall studs; not just to the plaster or wallboard. The cabinet with its shelves could be omitted in a very simple form of this general idea and the layout panel hinged directly to the wall.

If closet storage is available, you could simply mount your track on a panel and set it on the floor or some elevating device when you wish to operate your model raceway. Many of these ideas derive from layouts designed at an earlier date for model railroads.

Under-bed layout. An under-the-bed unit is much simpler to build and inclusion of a guard rail presents no problem. It is built on casters and designed to slide under a bed when not in use. Its size would be limited only by the length, width and clearance below the bed. The panel itself is, again, a sheet of plywood or Homasote. There is no need to consider double board construction as the casters elevate the panel sufficiently to permit wiring to be mounted on the underside.

Due to problems of clearance, it may not be possible to permanently mount larger structures on this layout; they may have to be stored separately. The basic raceway itself will be on the panel and ready for operation at a moment's notice. Use of a dust cover is recommended when the layout is stored away.

A word of caution. *Always use insulated staples* to secure the wire leads to accessories. Time and time again it has been found that mysterious short circuits in model layouts were by non-insulated staples.

A space-saving layout. The two-unit layout shown in the drawing is not properly a hideaway layout, although if the track

EXTERIOR TYPE

Grade	Typical Uses	1/4	5/16	3/8	1/2	5/8	3/4	1
EXT-DFPA-A-A	Use where appearance of both sides is important. Fences, carport enclosures, signs, boats, etc.	•		•	•	•	•	•
EXT-DFPA-A-B	Alternate for A-A. For uses requiring one surface highest appearance, opposite side solid and smooth.	•		•	•	•	•	•
A-C	Use where appearance of one side only is important such as siding, soffits, fences, store fronts and other exterior uses.	•		•	•	•	•	•
PLYFORM	Concrete form grade, maximum re-use. Can be re-used until wood is literally worn away. Edge sealed with distinctive red sealer. Mill oiled unless otherwise specified.					•	•	
B-C	Utility outdoor building panel. Farm buildings, etc.	•		•	•	•	•	
C-C	Base for tile, linoleum, etc., where unusual moisture conditions exist.	•		•	•	•	•	
C-C	Unsanded construction panel with waterproof bond.		•	•	•	•	•	

INTERIOR TYPE

Grade	Typical Uses	1/4	5/16	3/8	1/2	5/8	3/4	1
INT-DFPA-A-A	Use indoors where both sides to be in view. Cabinet doors, built-ins, furniture.	•		•	•	•	•	
INT-DFPA-A-B	Alternate for A-A. For uses requiring one surface highest appearance, opposite side solid and smooth.	•		•	•	•	•	
A-D	For interior use where high appearance of only one side is important such as paneling, built-ins and backing.	•		•	•	•	•	
PLYFORM	Re-usable concrete form plywood. Edge sealed with distinctive green sealer. Mill oiled unless otherwise specified.					•	•	
B-B	B-B utility panel. Used where two smooth sides are required.	•		•	•	•	•	
B-D	Utility panels for uses requiring one smooth, solid side. Backing, cabinet sides, etc.	•		•	•	•	•	
UNDERLAYMENT	Underlayment grade. Base for tile, linoleum, carpeting.	•		•	•	•	•	
PLYSCORD	Unsanded sheathing or structural grade. For sheathing, subflooring, etc., barricades.		•	•	•	•	•	
PLYSCORD	Unsanded structural grade panel with waterproof glue line. For sheathing, subfloor, etc.		•	•	•	•	•	
2-4-1 2-4-1	New combination subfloor and underlayment base for tile, linoleum, carpeting and wood strip flooring. Used on 4-foot span grid system.					7-Ply 1 1/8" Only		

Douglas Fir Plywood Assn. (American Plywood) designations.

is mounted on plywood or Homasote sections it would fall into the semi-permanent category. It is presented here because many hobbyists think of a model raceway layout only in terms of the conventional oval or figure 8, or have difficulty in manipulating their standard track sections.

The essential portions of a layout of this type are the two end sections, which are mirror images of each other. The straightaway that joins them may be of any length and while in racing it is best if the drivers can keep their cars in view, in crowded quarters the straightaway may have to be placed behind a couch or other furniture. As a matter of fact, the straightaway connecting the two end sections need not be all straight. Depending on the room in which the layout is set up it might be built as an L- or even a U-shaped track, giving a considerably greater length of run between the two end panels.

The two tracks of the straightaway should be as close as practical and still leave clearance. The two parallel lengths of track will give the appearance of a four-lane system. Of course, it is a two-lane layout and only two cars can be raced at once. The key to getting the layout in as small an area as possible and bringing the two tracks of the straightaway as close to each other as possible lies in the special straight sections. Its exact length will depend on the length of the standard straight sections in the make of track you are using, and on what fractional length straight sections (quarter, half and so on) are available.

In many cases the A sections will be about three-quarters the length of a standard straight and if no three-quarter straights are available this section can be built by combining a quarter and a half straight. It may be necessary for the A section to be a little longer than a standard straight, perhaps a full straight length plus a quarter length. The aim is to bring the two lines of track out parallel and as close as practical at the point where they join the straightaway.

Some makes of track do not provide any fractional straight sections. It may be necessary to carefully cut standard straight to provide the best length for the A sections. This is not exactly a snap, but can be accomplished with care and a fine-toothed hacksaw. With such a truncated section, the usual physical and electrical connecting devices will be lost at one end. This presents no great problem if the track is permanently mounted on plywood or Homasote. The physical connection is retained by carefully aligning the adjoining sections before screwing them down and the electrical connection by means of short jumper wires between the undersides of connecting rails. In soldering such connections be careful not to melt the plastic molding of the track.

If the end sections are mounted on plywood or Homasote, so should the straightaway section in order to keep all track at the same level. On a long straightaway, or a more complicated shape of connecting track it may be necessary to employ several strips or panels of mounting board. All of the sections will be held together firmly by the use of small hooks and eyes. The electrical connection between the tracks will be by means of the regular track connecting device.

If desired, a guard rail or coping may be built around the end sections where most derailments take place.

The concensus is that a table-height layout is most desirable. Those who are compelled to build low layouts because of lack of space for a permanent or hideaway table height layout may, however, think of themselves as viewing the race from a high grandstand seat. After all, in real racing, the spectators stand or sit at varying heights in relation to the cars; there is no one level from which real motor races are viewed.

See also: WOODWORKING.